



Charles E. Kellogg

EUROPEAN JOURNAL

Appendix I

1950

Programs and guidebooks
for Fourth International
Congress of Soil Science

Holland and Belgium



(1)

KELLOGG



PROGRAMME

Fourth International Congress
of
Soil Science

AMSTERDAM

July 24 – August 1, 1950



*Carver Lock Tower
- Christiaan Rembrand*

The reception-office (address 126 Nieuwe Prinsengracht) will be open daily from 8.30 a.m. until 5.30 p.m.

Meetings will begin punctually at the hours mentioned.

The official photograph of the Congress will be taken on the steps outside the „Indisch Instituut” after the opening session on Monday, July 24th at 3.45 p.m.

Reprints of papers ordered by authors should be applied for at the reception-office.

For lunch tickets and coupons for coffee or tea please apply at the reception-office.

PROGRAMME

FOURTH INTERNATIONAL CONGRESS OF SOIL SCIENCE

AMSTERDAM

July 24 – August 1, 1950

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Fisheries and Food, The Hague

His Excellency E. Graeffe, Ambassador of Belgium, The
Hague

His Excellency Mr M. Roem, High Commissioner of Indo-
nesia, The Hague

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N. H. Blink, Commissioner for Foreign Agricultural Affairs,
The Hague

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Prof. Dr J. C. Dorst, Rector Magnificus of the Agricultural
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Vice-Chairman: G. Aubert (France), J. A. Bonnet (Puerto Rico), L. Bramao (Portugal), E. C. J. Mohr (Netherlands), A. Reifenberg (Israel)

Secretary: H. A. Middelburg (7 Hinkeloordseweg, *Wageningen*, Netherlands), A. R. P. Janse, G. G. L. Steur

Section of Soil Conservation and Management

Chairman: J. P. Harroy (Belgium)

Vice-Chairman: D. A. Campbell (New Zealand), M. Greenwood (Nigeria), L. R. Patiño (Mexico)

Secretary: F. A. van Baren (15 Rubenslaan, *Naarden*, Netherlands), J. G. Vermaat

Section of Land Classification and Evaluation

Chairman: J. Mitchell (Canada)

Vice-Chairman: R. D. Hockensmith (U.S.A.), R. Tavernier (Belgium), G. Torstensson (Sweden)

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Section of Saline Soils

Chairman: J. K. Basu (India)

Vice-Chairman: S. A. Arany (Hungary), R. J. Best (Australia), G. Deloffre (France), M. Rizk (Egypt)

Secretary: A. J. Zuur (P.O. Box 5, *Kampen*, Netherlands), C. van den Berg, B. Verhoeven

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J. Temme (Secretary)

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Miss A. C. Schippers (Secretary)

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Miss A. C. Schippers (Head)

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Miss A. W. Dedel, Miss H. Hempenius, Miss L. Insinger,
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Wessem

Grants

Netherlands Government
Municipality of Amsterdam
Netherlands Society of Soil Science, Utrecht
Netherlands Chemical Society, The Hague
Royal Netherlands Geographical Association, Amsterdam
Central Nitrogen Sale Office, The Hague
Chilean Nitrate Trading Company, The Hague
Advisory Office for Superphosphate, Wageningen
Agricultural Office for Basic Slag, Wageningen
Netherlands Potash Import Company, Amsterdam
Netherlands Agricultural Lime Office, Zwolle
Central Office of the Horticultural Sales in the Netherlands,
The Hague
Central Bulb Committee, Haarlem
A. Volker's Company for Public Works, Rotterdam

Explanatory Notes

Only names of the main streets are mentioned.

Numbers refer to the tram-lines.

Black: congress buildings (entrance at arrow)

A: headquarters (reception-office, exchange-office, traveling-agency, bookstall)

room for the *general* lectures for the sections (except the four lectures in *plenary* sessions to be held in the „Indisch Instituut”)

rooms for sectional meetings of the sections *phys*, *clay*, *chem* and *biol*

B: rooms for sectional meetings of the sections *fert*, *trop* and *sal*

C: *plenary* sessions

rooms for the sectional meetings of the sections *cons* and *class*

exhibition

D: places for lunch

Abbreviations

plen plenary sessions

gen general lectures for the sections

phys section of Soil Physics

clay section of Clay Minerals

chem section of Soil Chemistry

biol section of Soil Biology

fert section of Soil Fertility

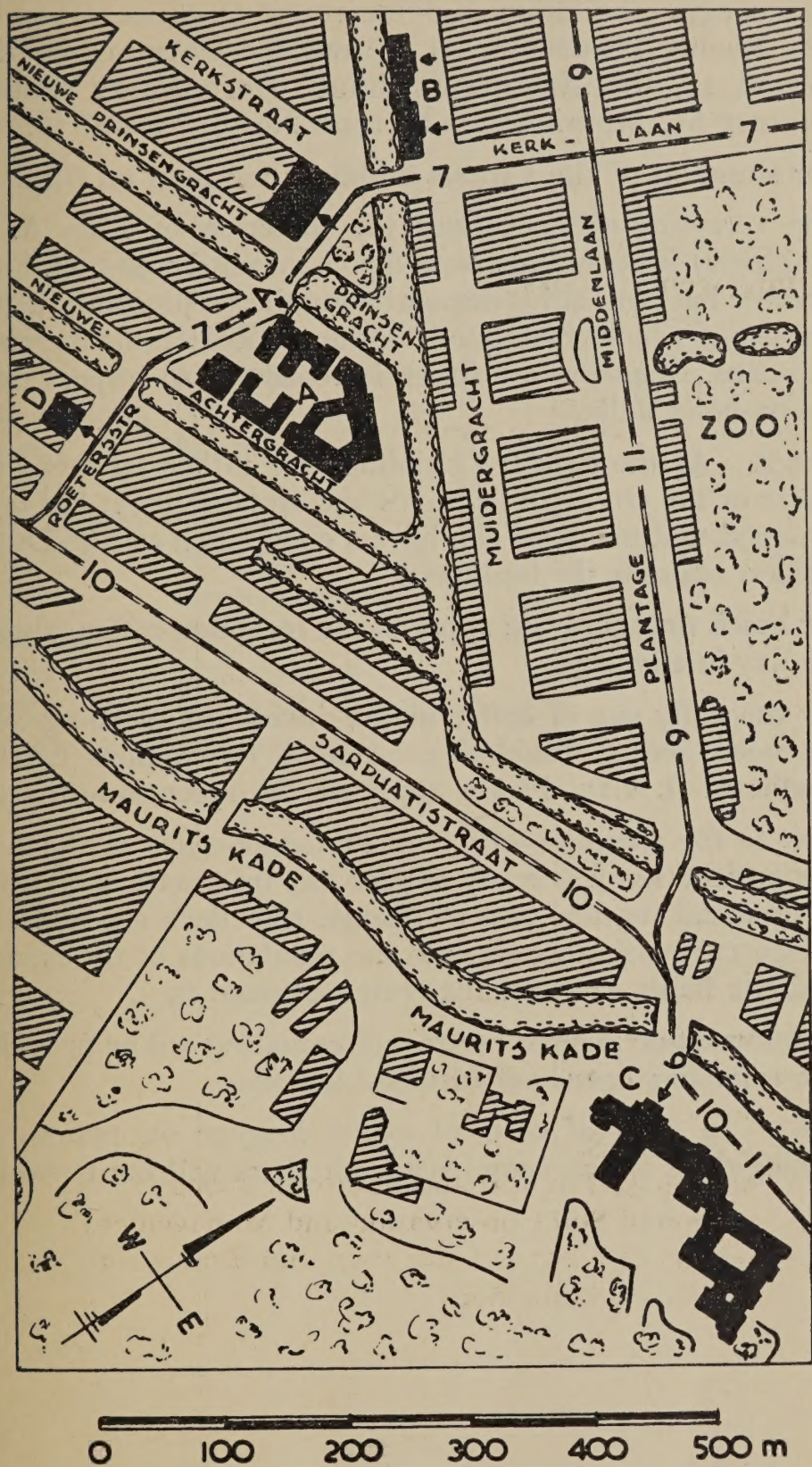
trop section of Tropical and Subtropical Soils

cons section of Soil Conservation and Management

class section of Land Classification and Evaluation

sal section of Saline Soils

SITUATION MAP of the Congress Buildings
and the “Indisch Instituut”



General Information

Dutch officers will wear an orange rosette.

The congress buildings and the reception-office (entrance 126, Nieuwe Prinsengracht) are reached by tram Nos 7, 9, 10 and 11, the „Indisch Instituut” (for plenary sessions, entrance 63, Mauritskade) by tram Nos 9, 10 and 11.

For situation of the various buildings see map on page 13.

The *reception-office* (under the direction of Miss A. C. Schippers) is open daily from 8.30 a.m. until 5.30 p.m. Each member has here at his disposal a numbered pigeon-hole, the number of which corresponds to the number on the membership-card. Members are urgently requested to inspect these pigeon-holes daily.

Lunch. As the congress buildings are rather far from the centre of the city with its hotels and restaurants, it has been arranged that members can have a good lunch at 1.50 Dutch guilders opposite the buildings.

For lunch tickets please apply to the reception-office, always one day in advance.

For the daily cup of coffee or tea during the morning- and afternoon recess, booklets containing 10 coupons can be bought at fl. 2.25. Please apply at the reception-office.

Next to the reception-office an *exchange-office* of the Amsterdamsche Bank is ready to give any information required on financial matters and to change traveller's cheques and foreign currency, according to the regulations of the Nederlandsche Bank. For exchange rates see page 15.

All information wanted on travelling matters will be provided by a *travelling agency* of Lissone-Lindeman.

Dress. In view of costs of excess luggage on planes, no evening-dress is necessary. Academic dress will not be worn.

Exchange Rates

(about 1st July 1950, without engagement)

Australia	A. £ 1.—	= fl. 8.51
Belgium	Bfrs. 100	= fl. 7.60
Canada	Can. \$ 1.—	= fl. 3.45
Denmark	Kron. 100	= fl. 55.—
Egypt	Eg. £ 1.—	= fl. 10.91
Finland	Mark. 100	= fl. 1.65
France	Ffrs. 100	= fl. 1.08
Great Britain	£ 1.—	= fl. 10.64
India	Rup. 100	= fl. 79.80
Israel	Isr. £ 1.—	= fl. 10.63
Italy	Lire 100	= fl. 0.61
New Zealand	NZ £ 1.—	= fl. 10.55
Norway	Kron. 100	= fl. 53.20
Portugal	Esc. 100	= fl. 13.20
South Africa	SA £ 1.—	= fl. 10.60
Spain	Ptas. 100	= fl. —.—
Sweden	Kron. 100	= fl. 73.40
Switzerland	Frs. 100	= fl. 86.90
Turkey	Lira 1.—	= fl. 1.36
U.S.A.	U.S.A. \$ 1.—	= fl. 3.79
Yugoslavia	Din. 100	= fl. 7.60

Consulates at Amsterdam

	ADDRESS	TEL. NO.
Argentina	701 Keizersgracht	32723
Austria	216 Herengracht	43418
Belgium	12 Nieuwe Doelenstraat	41123
Brazil	632 Keizersgracht	33115
Chile	289 Herengracht	30951
China	79a Apollolaan	97649
Czechoslovakia	44 Oranje Nassaulaan	27432
Denmark	139 De Ruyterkade	34145
Finland	1 Rigakade	48746
France	280 Herengracht	36535
Great Britain	460 Herengracht	33229
Greece	64 Sarphatistraat	52460
Israel	26 Joh. Vermeerstraat	97188
Italy	609 Herengracht	49540
Mexico	8 Vijgendam	39211
Norway	18 Geldersekade	33527
Poland	56 Koningslaan	93700
Portugal	701 Keizersgracht	35604
Spain	20 Oranje Nassaulaan	96591
Sweden	26 Koningslaan	90534
Switzerland	16 Joh. Vermeerstraat	97626
U.S.A.	19 Museumplein	90321

Embassies or Legations at The Hague

	ADDRESS	TEL. NO.
Argentina	3 Buitenrustweg	320844
Australia	18 Lange Voorhout	117606
Austria	31 Koninginnegracht	182074
Belgium	1c Andries Bickerweg	392390
Brazil	5 Adriaan Goedkooplaan	556580
Canada	1a Sophialaan	115963
Chile	32 Jan van Nassaustraat	777590
China	16 Alexanderstraat	115532
Czechoslovakia	1 Stadhouderslaan	330969
Denmark	13 Sophialaan	182258
Egypt	20 Surinamestraat	110303
Finland	58a Lange Voorhout	114548
France	15 Lange Vijverberg	114655
Great Britain	19 Laan	182660
Greece	17 Alexanderstraat	114058
Hungary	8 Oranjestraat	110135
India	2 Buitenrustweg	337531
Israel	16 Surinamestraat	115585
Italy	65f Zeestraat	112013
Mexico	47 van Lennepweg	551078
Norway	69 Laan Copes van Cattenburch	180166
Poland	25 Alexanderstraat	117987
Portugal	34 Wassenaarseweg	114438
South Africa	2c Alexander Gogelweg	334382
Spain	41 Daendelsstraat	771308
Sweden	26 Jan van Nassaustraat	774420
Switzerland	42 Lange Voorhout	117458
Turkey	29 Prinsessegracht	112958
U.S.A.	7 Benoordenhoutseweg	111835
Yugoslavia	114 Jan van Nassaustraat	777403

Congress Transactions

Volumes I and II of the Transactions will be finished before the beginning of the Congress. Volume III will be published after the Congress and be forwarded to the members. For reprints of papers authors should apply to the reception-office.

Post-Congress Excursions

through the Netherlands (August 2—12th) and Belgium (August 13—19th). Participants will receive a detailed guide to the excursions.

Exhibition "Soil and People"

In connection with the Congress a small exhibition has been arranged in the hall on the first floor of the „Indisch Instituut". It will give the visitor a short survey of the work done in the Netherlands on soil and soil fertility.

The quick growth of the Dutch population during the last century (see table) together with the limitations to the possibilities of enlarging the acreage of cultivated land has resulted in a very intensive use of the Dutch soil.

Growth of population in the Netherlands

1830	.	.	.	.	2.6	mill.
1900	.	.	.	.	5.1	„
1909	.	.	.	.	5.9	„
1920	.	.	.	.	6.9	„
1930	.	.	.	.	7.9	„
1939	.	.	.	.	8.8	„
1945	.	.	.	.	9.3	„
1950	.	.	.	.	10.0	„

The Dutch have to deal with different problems in facing the difficulties originating from the disproportion between population and acreage of cultivated land. One of these problems is the extension of the total acreage by the draining of lakes and bogs, the reclamation of coastal areas and the

recent enclosure and partial reclamation of the Zuiderzee (see „Zuiderzee Reclamation Works Noordoostpolder”). When this reclamation of the Zuiderzee will be finished, more than 25 % of the Netherlands will consist of reclaimed soil. The visitor will see everywhere the proofs of the struggle against the water.

In spite of the acquisition of new land the Dutch agricultural population wants still more land to carry on their industries. Therefore waste land is made fit for cultivation. Plots that have an unfavourable situation from an economical point of view are reallocated (see reclamation societies). Much attention is drawn to the organic matter supply of reclaimed poor sandy soils (town refuse). The destination of land for town-extension, recreational regions, the division of cultivated areas into pasture, arable and horticultural land are matters of great concern to the Government (Service of Physical Planning). One of the most important things in these schemes is the qualification of soils by studying their properties, both of topsoil and profile (Soil Survey Institute). Much attention is paid to the fertility of soils, intensive soil production only being possible when every factor that may be of influence on the fertility is taken into account. Much of the soil fertility work is done by Government Institutes (Agricultural Experiment Station and Institute for Soil Research). This work is closely connected with the results of the Soil Testing Laboratory. Here soil samples are analyzed. The principal investigations are concerned with pH, humus content, phosphate and potash (in 1949 about 1.9 million determinations).

The research work done at the Agricultural Experiment Station is chiefly concerned with pasture and arable land; problems of horticultural soils are investigated in several parts of the country depending on the character of horticulture in different regions (Experimental and Research Station for Fruit and Vegetable Glass Crops, Naaldwijk etc.). To enable the farmer and horticulturist to take advantage of the progress of agricultural science, two ways are followed by the Government:

1. each province (or part of a province) has its Government Agricultural Adviser for agriculture, horticulture, livestock breeding, etc.

2. prospective farmers and horticulturists are trained for their future occupations at Agricultural Schools (see exposition Ministry of Agriculture, Fisheries and Food).

As far as fertility of the soil is concerned, the use of great quantities of artificial fertilizers plays an important part in obtaining high yields from the cultivated land. There was a rapid increase of the use of fertilizers in the period from 1900 to 1940. During this period manufacturers and importers of fertilizers also laid out experimental fields with their products and gave financial support to scientific investigations carried out at Government Institutes. In the last few years some of them have their own Research Stations; as a rule these private institutes are working in close contact with the Government Institutes as far as scientific problems are involved. Some details about the importance of the soil for the Dutch economic situation are also given.

List of Institutes taking part in the exhibition

Ministry of Agriculture, Fisheries and Food, The Hague; Zuiderzee Reclamation Works, Kampen; Netherlands Land Reclamation Society, Arnhem; N.V. „Grontmij”, Soil Improvement and Reclamation Society, Zwolle; Government Service for Drainage, Land Improvement and Reallocation, Utrecht; Government Service of Physical Planning, The Hague; Soil Survey Institute, Bennekom; Agricultural Experiment Station and Institute for Soil Research T.N.O., Groningen; Soil Testing Laboratory, Groningen/Oosterbeek; Experimental and Research Station for Fruit and Vegetable Glass Crops, Naaldwijk; Chilean Nitrate Agricultural Service, Wageningen; Central Nitrogen Sale Office, The Hague; Advisory Office for Superphosphate, Wageningen; Agricultural Office for Basic Slag, Wageningen; Netherlands Potash Import Company, Amsterdam; Netherlands Agricultural Lime Office, Zwolle; Refuse Disposal Company „V.A.M.”, Amsterdam

Bookstall

At a bookstall organized by Kniphorst Booksellers, Wageningen a survey of Dutch publications in the field of soil science is given and some new soil scientific books are displayed or for sale.

Museums

Rijksmuseum (State Museum), 42 Stadhouderskade
picture-gallery, especially Dutch painters of the seventeenth century (among these Rembrandt's famous „Midnight Round", etc.)

special exhibition of 120 pictures of the Kaiser Friedrich Museum in Berlin

Stedelijk Museum (Municipal Museum), 13 Paulus Potterstraat

modern paintings

Indisch Museum, 2 Linnaeusstraat

economic, ethnological and tropical-hygienic collections of Indonesia, Surinam and the Antilles

Restaurants in Amsterdam

„*Excelsior*" (Hotel de l'Europe), 24 Nieuwe Doelenstraat
(music and dancing)

„*Dikker & Thijs*", 444 Prinsengracht (music)

„*De Smorre*", 50-52 Kerkstraat (music)

„*Lido*", 105 Leidsekade (music, nice view on canal)

„*Het Brouwerswapen*", 41 Rembrandtsplein (beer-restaurant)

Brasserie de Bock „*In de Smidse*", 26 Korte Leidsedwarsstraat

„*Astoria*", 22-26 Vijzelstraat (with snack-bar)

„*Kempinski*", 95 Leidsestraat

„*Dorrius*", 338-342 N.Z. Voorburgwal

„*Carlton Corner House*", 2 Vijzelstraat

Good restaurants in all Hotels.

Italian Restaurants

„*la Pergola*", 20-22 Amstel

„*Mirafiori*", 2 Hobbemastraat

Chinese Restaurants

„*Nanking*", 5-9 Leidseplein

„*Pekings*", 515 Herengracht, corner Vijzelstraat

„*King Long*", 115-119 N.Z. Voorburgwal

Fish Restaurants

„Saur”, 134 Rokin

„Rienstra”, 51 Lange Leidsedwardsstraat

Interesting Old Dutch Bars

Wijnand Fockink, 29 Pijlsteeg (speciality „half on half” and „old dutch gin”) closed 6 p.m., on Saturday 1 p.m.

Bootz „De drie fleschjes” (the three bottles), 16 Gravenstraat (speciality „apricot brandy”, „Oranje Bootz”, „old and new dutch gin”) closed 6 p.m., on Saturday 1 p.m.

Café's

Café of American Hotel, 28-30 Leidseplein

Café of Lido (and bar), 105 Leidsekade

Café of Excelsior (and bar), 24 Nieuwe Doelenstraat

Café Astoria (and bar), 22-26 Vijzelstraat

Café Formosa (and lunchroom), 156 Kalverstraat

Romantic Grills

„*The five Flies*” (Mother Hendrina), 294 Spuistraat

Closed on Sunday

„*Ye olde Cellar*” (Hall of Knights), 1 Vijff Vliegensteeg
(corner 292 Spuistraat)

Closed on Sunday

„*Jan v. d. Heyden*” (Fiveclub), 8 Bergstraat

Closed on Sunday

„*The Leuwenburgh*”, 14 O.Z. Voorburgwal (in the oldest part of the town)

Closed on Sunday

GENERAL PROGRAMME

Monday, July 24th

- 8.30 a.m. opening of the reception-office, enrolment and distribution of congress papers etc.
- 2.30 p.m. inaugural session (Indisch Instituut): welcome by Dr D. J. Hissink; official opening by His Excellency S. L. Mansholt, Minister of Agriculture; presidential address by C. H. Edelman
- 4.00 p.m. meeting of sectional officers
- 8.30 p.m. meeting in honour of Dr D. J. Hissink and informal reception at Hotel „Krasnapolsky” (opposite the Royal Palace)

Tuesday, July 25th

- 9.15 a.m. lecture for the whole congress (Indisch Instituut) on “Soil structure” by R. Bradfield (U.S.A.)
- 11.00 a.m. lecture for the Section of Clay Minerals on “The electrochemistry of clay minerals in relation to pedology” by C. E. Marshall (U.S.A.)
- 11.00 a.m. sectional meetings of other sections
- 2.30 p.m. lecture for the Section of Biology on “A survey of biological nitrogen fixation in relation to the world supply of nitrogen” by H. L. Jensen (Denmark)
- 2.30 p.m. sectional meetings of other sections
- 4.00 p.m. discussion on the future organisation of the International Society of Soil Science
- 8.30 p.m. reception by the Netherlands Government and the Municipal Authorities of Amsterdam at the Rijksmuseum (42 Stadhouderskade)

Wednesday, July 26th

- 9.15 a.m. lecture for the whole congress (Indisch Instituut) on “Diagnosis of soil fertility by visual symptoms of crops” by T. Wallace (England)

11.00 a.m. lecture for the Section of Soil Chemistry on "Some soil organic matter relationships" by F. E. Bear (U.S.A.)

11.00 a.m. sectional meetings of other sections

2.30 p.m. lecture for the Section of Tropical and Subtropical Soils on "Tropical soils" by C. E. Kellogg (U.S.A.)

2.30 p.m. sectional meetings of other sections

4.00 p.m. sectional meetings

8:00 pm - TAC

Thursday, July 27th

9.15 a.m. lecture for the whole congress (Indisch Instituut) on "Modern soil conservation" by H. H. Bennett (U.S.A.)

11.00 a.m. excursion to Gooi-region and Noordwijk

Friday, July 28th

9.15 a.m. lecture for the whole congress (Indisch Instituut) on "The classification and use and misuse of land" by L. Dudley Stamp (England)

11.00 a.m. lecture for the Section of Soil Physics on "Soil moisture and evaporation" by R. K. Schofield (England)

11.00 a.m. sectional meetings of other sections

2.30 p.m. lecture for the Section of Soil Fertility on "Fundamental problems regarding phosphate and potash deficiencies in relation to chemical soil investigations" by L. Gisiger (Switzerland)

2.30 p.m. sectional meetings of other sections

4.00 p.m. sectional meetings

Saturday, July 29th

9.15 a.m. "Soil science and its applications in the Netherlands" (Indisch Instituut) under the auspices of the Netherlands Society of Soil Science

2.30 p.m. trip by boat through the canals and the harbour of Amsterdam

Sunday, July 30th
free

Monday, July 31st

- 9.15 a.m. lecture for the Section of Soil Biology on "Soil fauna and its importance in soil type formation" by C. H. Bornebusch (Denmark)
- 9.15 a.m. sectional meetings of other sections
- 11.00 a.m. lecture for the Section of Soil Conservation and Management on "Progress in shifting cultivation in Indonesia" by J. H. de Haan (Indonesia)
- 11.00 a.m. sectional meetings of other sections
- 2.30 p.m. lecture for the Section of Saline Soils on "Chemical and physical characteristics of saline and alkali soils of Western United States" by L. A. Richards (U.S.A.)
- 2.30 p.m. sectional meetings of other sections
- 4.00 p.m. sectional meetings

Tuesday, August 1st

- 9.15 a.m. sectional meetings
- 11.00 a.m. sectional meetings (conclusions from the discussions)
- 2.30 p.m. new foundation of the International Society of Soil Science (Indisch Instituut)
- 4.00 p.m. closing session (Indisch Instituut)

All the meetings will begin punctually at the hours mentioned.

For Tuesday, July 25th and Friday, July 28th special excursions for the ladies have been arranged.

SECTIONAL PROGRAMMES

Procedure in the Sectional Meetings

For section rooms see map on page 13 (follow the arrows to your section). In the sectional programmes numbers following the titles of the papers refer to the Volume of the Transactions and the number of the paper.

Time available for each paper will depend on the number of papers and may be extended or diminished at the discretion of the Chairman.

Contributors to the discussion are requested to write a summary of their questions and remarks on the form provided, and to hand it to the Secretary of the Section, who will be present at each session.

Authors wishing to demonstrate slides are requested to hand these to the Secretary of the Section before the beginning of the session.

All sessions will begin punctually at the hours mentioned.

Section of Soil Physics

Tuesday, July 25th

- 9.15 a.m. *R. Bradfield, Soil structure* (II - 112)
- 11.00 a.m. *C. E. Marshall, The electrochemistry of the clay minerals in relation to pedology* (I - 14)
- 2.30 p.m. *evaluation of soil structure*
M. Gračanin, To the problem of evaluation of soil structure (I - 4)

Wednesday, July 26th

- 9.15 a.m. *T. Wallace, Diagnosis of soil fertility by visual symptoms of crops* (I - 1)
- 11.00 a.m. *genesis of soil structure*
K. C. Hou and C. H. Huang, Plasticity curves determination, a physico-chemical method of soil analysis (I - 5)
E. Frei, Genesis of various types of soil structure (I - 6)

J. M. Albareda and C. Rodriguez Munoz, Surface phenomena in the manifestation of anisotropy in aqueous clay suspensions (I - 7)

A. J. Low, Rate of build-up of water-stable aggregates and soil crumb structure (III)

2.30 p.m. *organic matter and soil structure; soil structure and crops; soil structure and erosion*

P. K. Peerlkamp, The influence on soil structure of the „natural organic manuring” by roots and stubbles of crops (I - 8)

M. A. J. Goedewaagen and J. J. Schuurman, Root production by agricultural crops on arable land and on grassland as a source of organic matter in the soil (II - 114)

L. de Leenheer et M. de Boodt, La dégradation de la structure des polders marins belges, son évaluation et ses causes (I - 9)

Thursday, July 27th

9.15 a.m. *H. H. Bennett, Modern soil conservation* (I - 2)

Friday, July 28th

9.15 a.m. *L. Dudley Stamp, The classification and use and misuse of land* (I - 3)

11.00 a.m. *R. K. Schofield, Soil moisture and evaporation* (II - 113)

2.30 p.m. *determination of soil moisture*

S. B. Hooghoudt, Irreversibly dried-up peat, clayey peat and peaty clay soils, the determination of the degree of reversibility (II - 115)

B. Ramsauer, Die Bodenfeuchteganglinie (II - 116)

J. J. Fripiat, Variation de la constance diélectrique d'une terre en fonction de son humidité (III)

Saturday, July 29th

9.15 a.m. *soil science and its applications in the Netherlands*

Monday, July 31st

9.15 a.m. *movement of soil moisture in unsaturated soils*

E. C. Childs and N. C. George, Movement of moisture in unsaturated soils (I - 10)

G. Bryssine, Humidité et possibilité de lessivage des sols au Maroc (Rabat) (I - 11)

L. A. Richards, Experimental demonstration of the hydraulic criterion for zero flow of water in unsaturated soil (I - 12)

D. A. de Vries, Some remarks on heat transfer by vapour movement in soils (II - 117)

D. A. de Vries, Some remarks on gaseous diffusion in soils (II - 118)

2.30 p.m. *L. A. Richards, Chemical and physical characteristics of saline and alkali soils of Western United States* (I - 99)

4.00 p.m. *soil moisture influencing yield and quality of crops*

L. J. A. de Jonge and H. Smits, Control of damage caused by drought on permanent pastures with a soil profile showing a shallow layer of clay underlain by peat (II - 119)

L. de Leenheer and K. de Caestecker, The influence of rainfall on the crop production on eight soil types in the old sea polders of Belgium (II - 120)

W. C. Visser, The possibility of exact regulation of the depth of drainage (II - 121)

Tuesday, August 1st

9.15 a.m. joint session with the Section of Soil Biology
M. J. Geoghegan, Aggregate formation in soil (I - 45)

10.00 a.m. *wilting; crops influencing soil moisture*

G. Grillot, La jachère et l'humidité des sols au Maroc (Rabat) (I - 13)

J. J. Fripiat, Comportement vis-à-vis de l'eau des sols du Congo Belge (III)

11.00 a.m. conclusions from discussions



Section of Clay Minerals

Tuesday, July 25th

9.15 a.m. *R. Bradfield, Soil structure* (II - 112)

11.00 a.m. *C. E. Marshall, The electrochemistry of the clay minerals in relation to pedology* (I - 14)

2.30 p.m. *structure of clay minerals and interstratified clay minerals*

G. W. Brindley, The structure of clay minerals (I - 15)

W. F. Bradley, Interstratified growths in clays and clay-like minerals (I - 21)

J. Mering, Les réflexions des rayons X par les minéraux argileux interstratifiés (III)

Wednesday, July 26th

9.15 a.m. *T. Wallace, Diagnosis of soil fertility by visual symptoms of crops* (I - 1)

11.00 a.m. *differential thermal analysis of clay minerals*

R. C. Mackenzie, Differential thermal analysis of clay minerals (II - 122)

V. Aleixandre, Differential thermal analysis of some Spanish clays and kaolins (I - 22)

P. L. Arens, Differential thermal analysis, a conventional method (III)

2.30 p.m. *solvation of clay minerals in relation to crystal structure*

D. M. C. Mac Ewan, Interlamellar adsorption by clay minerals (I - 23)

E. Forslind, Some remarks on the interaction between the exchangeable ions and the adsorbed water layers in montmorillonite (I - 24)

S. Caillère et S. Hénin, Sur l'hydratation de divers silicates et hydroxydes (III)

M. Longuet-Escard, Fixation des hydroxydes par la montmorillonite (III)

C. P. de Wit and P. L. Arens, Moisture content and density of some clay minerals and some remarks on the hydration pattern of clay (II - 123)

A. Mathieu-Sicaud, J. Mering et I. Perrin-Bonnet, Electro-microscopie des montmorillonites saturées de différents cations (III)

G. F. Walker and A. Milne, Hydration of vermiculite saturated with various cations (II - 124)

E. Gutiérrez Rios and J. L. Martin Vivaldi, Hydration of layer-lattice silicates with exchangeable cations (II - 125)

Thursday, July 27th

9.15 a.m. *H. H. Bennett, Modern soil conservation* (I - 2)

Friday, July 28th

- 9.15 a.m. *L. Dudley Stamp, The classification and use and misuse of land (I - 3)*
- 11.00 a.m. *R. K. Schofield, Soil moisture and evaporation (II - 113)*
- 2.30 p.m. *solvation of clay minerals (continued)*
S. B. Hendricks and R. S. Dyal, Surface measurement for ethylene glycol retention of clays and its application to potassium fixation (II - 126)
A. Hoyos de Castro, Influence of the potassium fixation on the hydration of montmorillonite (II - 127)
M. Bloch, Fixation du chlorure d'argent par la montmorillonite (III)
A. Hoyos and J. Rodriguez, Influence of thermal treatment on some physico-chemical properties of bentonite (II - 128)
- 4.00 p.m. joint session with the Section of Soil Chemistry

Saturday, July 29th

- 9.15 a.m. *soil science and its applications in the Netherlands*

Monday, July 31st

- 9.15 a.m. *genesis and synthesis of clay minerals and their mutual transformation*
S. Caillère et S. Hénin, Quelques remarques sur la synthèse des minéraux argileux (I - 16)
J. van Schuylenborgh, The electrokinetic behaviour of the sesquioxide hydrates and its bearing on the genesis of clay minerals (I - 17)
G. Millot, Comparaison des indications de la pédologie et de la géologie au sujet de la genèse des minéraux argileux (III)
E. Gutiérrez Rios and F. Gonzalez Garcia, Genesis of the bentonite from Tidinit (Spanish Morocco) (I - 18)
S. Caillère et S. Hénin, Mécanisme d'évolution des minéraux phylliteux (I - 19)
W. Dekeyser, A. van Rijssen and T. Dewiest, Studies on micaceous and clay minerals (I - 20)
P. Franzen and J. J. B. van Eyk van Voorthuysen, Synthesis of nickel hydrosilicates (III)

2.30 p.m. *meeting on the Technology of Clay Minerals organized in collaboration with the C.I.P.E.A. and some Clay Groups*

R. E. Grim, General review of the technology of clay minerals

S. Caillère, Le comportement des argiles au cours du chauffage

A. L. Roberts, Changes which occur on firing clay minerals

H. van Olphen, Stabilization of montmorillonite soils by chemical treatment.

M. Lépingle, Au sujet de l'analyse chimique des argiles

M. Glaeser, Complexes montmorillonite-corps organiques en phase vapeur

J. Escard, Adsorption de l'azote à basse température par la montmorillonite; effets de l'eau résiduelle et des cations échangeables

Tuesday, August 1st

9.15 a.m. joint session with the Section of Tropical and Subtropical Soils

11.00 a.m. conclusions from discussions



Section of Soil Chemistry

Tuesday, July 25th

9.15 a.m. R. Bradfield, *Soil structure* (II - 112)

11.00 a.m. C. E. Marshall, *The electrochemistry of the clay minerals in relation to pedology* (I - 14)

2.30 a.m. *mineralogy in soil science*

J. M. Albareda, V. Aleixandre and M. del Carmen Sanchez Calvo, Contribution to the study of Spanish slates of the Silurian (II - 129)

F. Burriel and V. Aleixandre, Spanish soils for rice cultivation (II - 132)

J. Perez Mateos and M. Munoz Taboadela, Mineralogical analysis of sediments from a zone of regional metamorphism (II - 130)

J. M. Albareda, V. Aleixandre and J. Garcia Vicente, Variation of the physico-chemical properties of clays with regard to grain size (II - 131)

L. de Leenheer, Mineralogical characterisation of the sand fraction in soil profiles (II - 133)

L. de Leenheer, Practical importance of a medium reserve of alterable minerals (orthoclase) under temperate climate (Belgium) (II - 134)

Wednesday, July 26th

9.15 a.m. *T. Wallace, Diagnosis of soil fertility by visual symptoms of crops* (I - 1)

11.00 a.m. *F. E. Bear, Some soil organic matter relationships* (I - 25)

2.30 p.m. *mineralogy in soil science* (continued)

4.00 p.m. *soil organic matter*

S. Hénin et R. Betremieux, Essais de pédologie expérimentale (I - 33)

S. Hénin et L. Turc, Essais de fractionnement des matières organiques du sol (I - 34)

J. Tinsley, The determination of organic carbon in soils by dichromate mixtures (I - 36)

N. Martin Retortillo, Study of the humus of some Spanish peats (II - 138)

J. de la Rubia Pacheco and F. Blasco Lopez-Rubio, Rapid determination of total organic matter in soils by ceriometry (II - 139)

F. Blasco Lopez-Rubio and J. de la Rubia Pacheco, Quantitative determination of humic colloids with ammonium hexanitrocerate (II - 140)

Ph. Duchaufour, Note sur les types d'humus forestier et leur rapport carbone/azote (C/N) (II - 141)

Thursday, July 27th

9.15 a.m. *H. H. Bennett, Modern soil conservation* (I - 2)

Friday, July 28th

9.15 a.m. *L. Dudley Stamp, The classification and use and misuse of land* (I - 3)

11.00 a.m. *soil organic matter* (continued)

2.30 p.m. *L. Gisiger, Grundsätzliche Fragen zur Bestimmung des Phosphorsäure- und Kalibedürfnisses auf Grund der chemischen Bodenuntersuchung* (I - 49)

4.00 p.m. *exchange capacity*

R. G. Menzel and M. L. Jackson, Sorption of copper from acid systems by kaolinite and montmorillonite (I - 26)

A. Mehlich, Cation exchange - anion exchange ratios of kaolinitic soil colloids (I - 28)

A. Malquori and L. Wiklander, Influence of alternate wetting and drying on potassium and magnesium fixation and base exchange capacity of synthetic aluminium and iron silicates (I - 31)

H. W. van der Marel, The mineralogical composition of the clay ($< 2 \mu$) separate of the Dutch soils and their cationic exchange capacity (II - 135)

H. van Olphen, A tentative method for the determination of the base exchange capacity of clays (II - 137)

B. B. Roy and S. C. Das, Electro-chemical properties of hydrogen clays from typical Indian soils (III)

L. de Leenheer, M. de Boodt et W. Welvaert, La détermination de la capacité d'échange de la fraction minérale et organique dans les sols des polders marins belges (I - 27)

C. Y. Peng, S. W. Chang and K. C. Hou, Nutrients absorption by soils in relation to soil plasticity (I - 29)

E. W. Russell and G. A. Cox, The direct determination of ionic activity products or ratios in soils (I - 30)

A. Wild, The effect of neutral salts on the retention of phosphate by clay at various pH values (I - 32)

H. W. van der Marel, The determination of the cationic exchange capacity of the inorganic soil particles (II - 136)

Saturday, July 29th

9.15 a.m. *soil science and its applications in the Netherlands*

Monday, July 31st

9.15 a.m. *exchange capacity* (continued)

2.30 p.m. *L. A. Richards, Chemical and physical characteristics of saline and alkali soils of Western United States* (I - 99)

Tuesday, August 1st

9.15 a.m. conclusions from discussions

Section of Soil Biology

Tuesday, July 25th

9.15 a.m. *R. Bradfield, Soil structure (II - 112)*

11.00 a.m. *transmutation of organic compounds by micro-organisms*

H. Lees, Some aspects of the carbon and nitrogen metabolisms of soil (I - 39)

R. L. Hausenbuiller and C. D. Moodie, A study of methods for evaluating changes in organic matter undergoing decomposition in the soil (III)

F. C. Gerretsen, Microbiological transformation of nitrogen and its influence on nitrogen availability in the soil (II - 143)

2.30 p.m. *H. L. Jensen, A survey of biological nitrogen fixation in relation to the world supply of nitrogen (I - 37)*

Wednesday, July 26th

9.15 a.m. *T. Wallace, Diagnosis of soil fertility by visual symptoms of crops (I - 1)*

11.00 a.m. *F. E. Bear, Some soil organic matter relationships (I - 25)*

2.30 p.m. *transmutation of organic compounds by micro-organisms (continued)*

V. Treccani, Oxidative activity of a soil microorganism (I - 40)

R. Treccani-Benetti and A. Schiesser, Action of some Flavobacteria on benzoic acid and various phenols (I - 41)

G. Rappe, Seasonal variations observed in the nutritive substances of a cultivated sphagnum peat soil (I - 35)

E. G. Mulder, Effect of liming of an acid peat soil on microbial activity (II - 144)

A. Kaila, On the dependence of the amount of organic phosphorus on the carbon content in soil (I - 42)

Thursday, July 27th

9.15 a.m. *H. H. Bennett, Modern soil conservation (I - 2)*

Friday, July 28th

9.15 a.m. *L. Dudley Stamp, The classification and use and misuse of land (I - 3)*

11.00 a.m. *transmutation of inorganic compounds by microorganisms*

J. Meiklejohn, The pure culture isolation of *Nitrosomonas europaea* (I - 44)

W. F. Bartholomew and F. E. Clark, Nitrogen transformations in soil in relation to the rhizosphere microflora (II - 142)

A. S. Abdel-Ghaffar and O. N. Allen, Effects of certain microorganisms on the growth and function of Rhizobia (III)

2.30 p.m. *L. Gisiger, Grundsätzliche Fragen zur Bestimmung des Phosphorsäure- und Kalibedürfnisses auf Grund der chemischen Bodenuntersuchung (I - 49)*

Saturday, July 29th

9.15 a.m. *soil science and its applications in the Netherlands*

Monday, July 31st

9.15 a.m. *C. H. Bornebusch, Soil fauna and its importance in soil type formation (I - 38)*

11.00 a.m. *transmutation of inorganic compounds by microorganisms (continued)*

J. K. Baars, Manganese deposits in rice fields (I - 43)

M. I. Timonin, Soil microflora in relation to manganese deficiency (III)

E. G. Mulder, Molybdenum in relation to nitrogen fixation of leguminous crops (II - 146)

2.30 p.m. *the fate in soil of insecticides, herbicides and fumigants*

F. E. Clark, The use of ethylene oxide for soil sterilization (I - 47)

A. G. Norman, The fate of complex organic compounds in soil (III)

4.00 p.m. *soil fauna*

J. Doeksen, An electrical method of sampling soil for earthworms (II - 148)

F. S. J. Hollick, Methods of collecting the Arthropod-population from soil samples (III)

Tuesday, August 1st

9.15 a.m. *influence of microorganisms on soil structure*

M. J. Geoghegan, Aggregate formation in soil (I - 45)

10.00 a.m. *miscellaneous*

M. A. Roulet et W. H. Schopfer, Les vitamines du sol et leur signification (I - 46)

E. H. Reinau, Ertragsbedingende, biotisch phytogene kohlenstoffhaltige Bodensubstanzen im Pflanzenbau (II - 145)

F. A. Skinner, The growth of species of Streptomyces in soil (II - 147)

L. Vilas and G. Gonzalez, Viability of Anthracis bacillus spores according to different characteristics of the soil (I - 48)

M. W. Tschapek and J. Garbosky, The principles of adsorption of the Azotobacter (III)

11.00 a.m. *conclusions from discussions*

Section of Soil Fertility

Tuesday, July 25th

9.15 a.m. *R. Bradfield, Soil structure* (II - 112)

11.00 a.m. *special problems*

F. van der Paauw, Periodical fluctuations of soil fertility and crop yields (II - 157)

J. J. Lehr, Seasonal variations in the pH value of the soil, as influenced by nitrification (II - 158)

D. A. van Schreven, Loss of nitrogen from ammonia-containing fertilizers applied to calcarious soils of the Zuiderzee polders (I - 64)

P. H. Nye, The relation between nitrogen responses, previous soil treatment and the carbon/nitrogen ratio in soils of Gold Coast savannah areas (I - 60)

2.30 p.m. *H. L. Jensen, A survey of biological nitrogen fixation in relation to the world supply of nitrogen (I - 37)*

Wednesday, July 26th

9.15 a.m. *T. Wallace, Diagnosis of soil fertility by visual symptoms of crops (I - 1)*

11.00 a.m. *F. E. Bear, Some soil organic matter relationships (I - 25)*

2.30 p.m. *factors influencing nutrient uptake*

H. P. Cooper, W. R. Paden and J. H. Mitchell, Differential in the nutrient content of calcium accumulating cotton plants and the silicon accumulating wheat plants (I - 57)

A. Aslander, Some new aspects of liming (I - 59)

A. Mehlich and J. Fielding Reed, Hydrogen in soils in its relation to mineral content of plants (I - 62)

A. C. Schuffelen, On the cation absorption of plants in relation to the composition of the soil absorbing complex (II - 160)

4.00 p.m. *plant analysis*

H. J. Atkinson, R. C. Turner and A. J. Mac Lean, Analysis of plants for potassium in soil fertility studies (I - 54)

V. J. Aaltonen, Die Blattanalyse als Bonitierungsgrundlage des Waldbodens (I - 55)

F. van der Paauw, Plant analysis as a means of evaluation of chemical soil tests (I - 56)

A. H. Cottenie, Investigations about the P_2O_5 -contents of clover and grass as influenced by different soil treatments (II - 155)

Thursday, July 27th

9.15 a.m. *H. H. Bennett, Modern soil conservation (I - 2)*

Friday, July 28th

9.15 a.m. *L. Dudley Stamp, The classification and use and misuse of land (I - 3)*

11.00 a.m. *minor elements*

A. Hasler, Über das Verhalten des Kupfers im Boden (I - 61)

F. Steenbjerg, On the relative contents of plant nutrients in crops (I - 63)

W. Plant, The relation of molybdenum deficiency to the acid soil complex (II - 156)

M. P. Löhnis, Manganese toxicity in beans (I - 53)

D. Mulder, A survey of nutritional diseases of fruit trees in relation to soil conditions in the Netherlands (II - 154)

2.30 p.m. L. Gisiger, *Grundsätzliche Fragen zur Bestimmung des Phosphorsäure- und Kalibedürfnisses auf Grund der chemischen Bodenuntersuchung* (I - 49)

4.00 p.m. *chemical methods of soil analysis*

F. Burriel and V. Hernando, The colorimetric determination of phosphorus in Spanish soils (II - 149)

F. Burriel and V. Hernando, Extraction of the total phosphorus from Spanish soils (II - 150)

F. Burriel and V. Hernando, The determination of assimilable phosphorus in Spanish soils (II - 151)

A. van den Hende, La valeur des méthodes chimiques pour la recherche du besoin en acide phosphorique des sols belges (I - 50)

L. Yankovitch, Méthode d'analyse physiologique du sol utilisée en Tunisie (I - 52)

Saturday, July 29th

9.15 a.m. *soil science and its applications in the Netherlands*

Monday, July 31st

9.15 a.m. C. H. Bornebusch, *Soil fauna and its importance in soil type formation* (I - 38)

11.00 a.m. *chemical methods of soil analysis (continued)*

C. Bould, The influence of cultural practices on the nutrient uptake of apples (I - 65)

H. A. Middelburg, Manganese mobilization and fertility of tropical volcanic ash soils (II - 152)

W. C. Visser, The objective of soil description by application of single values (II - 161)

Suber shows profiles for 1 meter to center
to cross due to erosion - possibly a question
near D. Joerges

1. m	35 -	20
	25 -	

2.30 p.m. *L. A. Richards, Chemical and physical characteristics of saline and alkali soils of Western United States (I - 99)*

4.00 p.m. *tracers; miscellaneous*

S. B. Hendricks and L. A. Dean, Use of P^{32} in measurement of fertilizer effectiveness under field conditions (I - 51)

R. Scott Russell, R. P. Martin and S. N. Adams, The problem of radiation damage in fertilizer studies with labelled phosphate (II - 153)

A. Aslander, The availability of phosphates after standard fertilization (II - 159)

M. Winnik, Some effects of P and K deficiencies on orange tree growth, composition and fruit quality (I - 58)

Tuesday, August 1st

9.15 a.m. conclusions from discussions

*a) Rapobany explains
how mineral, nitrogen
with light mixed on
pepper & heavy barrel.
heavy & light.
This with different coating
get sprayed. Even Fe
cover them.*

Section of Tropical and Subtropical Soils

Tuesday, July 25th

9.15 a.m. *R. Bradfield, Soil structure (II - 112)*

11.00 a.m. *lateritic soils*

M. van der Voort, The lateritic soils of Indonesia (I - 67)

J. A. Bonnet, Latosols of Puerto Rico (I - 68)

T. N. Jewitt, Goz soils of the Anglo-Egyptian Sudan (I - 69)

H. Greene, So called irreversible laterisation (II - 164)

C. R. van der Merwe, Red and yellow earths (II - 162)

C. R. van der Merwe, Ground water lateritic soils (ouklip soils) (II - 163)

S. P. Raychaudhuri, Red and lateritic soils of India (III)

Godinho - Gourea *Pantagon East of Wayang* 39
a) test soil types *6) Pansol says it's*
Prig. make into gravel research.
Shaved general soil like wheat - from seed to seed
deled - Processes yes, but mapping too.
general mapping done

2.30 p.m. *tropical black and hydromorphic soils*

F. F. R. Koenigs, A „sawah” profile near Bogor (Java) (I - 73)

T. W. G. Dames, Margalite soils in Indonesia (II - 166)

B. Polak, Occurrence and fertility of tropical peat soils in Indonesia (II - 167)

C. R. van der Merwe, „Vlei” soils (II - 165)

R. V. Tamhane, „Regur” soils of India (III)

Wednesday, July 26th

9.15 a.m. *T. Wallace, Diagnosis of soil fertility by visual symptoms of crops* (I - 1)

11.00 a.m. *subtropical soils*

J. M. Albareda and E. Gutiérrez Rios, Mountainous Spanish soils (I - 70)

J. M. Albareda, F. Burriel and M. Munoz Taboadela, Study of Andalusian black soils and the reason for their colour (II - 169)

L. Bramao, S. Garcia, S. Marques and A. Teixeira, The soil map of Portugal (I - 71)

N. H. Taylor, J. K. Dixon and F. T. Seelye, The soils of North Auckland Peninsula, New Zealand (I - 72)

J. M. Albareda and T. Alvira, Mediterranean soils of the Spanish Levant and North Africa (II - 168)

W. J. van Liere, A soil survey of the Adana Delta (Turkey) (II - 170)

C. R. van der Merwe, Subtropical black clays (II - 171)

2.30 p.m. *C. E. Kellogg, Tropical soils* (I - 66)

Thursday, July 27th

9.15 a.m. *H. H. Bennett, Modern soil conservation* (I - 2)

Friday, July 28th

9.15 a.m. *L. Dudley Stamp, The classification and use and misuse of land* (I - 3)

11.00 a.m. *R. K. Schofield, Soil moisture and evaporation*
(II - 113)

2.30 p.m. *chemical and physical research of tropical soils*

2) *Bonner - Savan conference*
J. C. de Gee, Preliminary oxidation potential determinations in a „sawah” profile near Bogor (Java)
(I - 74)

Ching-Kwei Lee, Exchangeable potassium in lateritic soils of China derived from different parent materials (I - 75)

W. L. Kubiëna, Zur Mikromorphologie der braunen und roten Tropenböden (I - 76)

H. Kiel, The mineralogical investigation of sands as a method to determine the mineral reserve of soils
(II - 172)

Saturday, July 29th

9.15 a.m. *soil science and its applications in the Netherlands*

Monday, July 31st

11.00 a.m. *J. H. de Haan, Progress in shifting cultivation in Indonesia* (I - 80)

2.30 p.m. *discussion on the nomenclature of tropical and subtropical great soil groups*

Tuesday, August 1st

9.15 a.m. *clay minerals of tropical soils*

C. H. Edelman, The isoelectric formation of lateritic soils (I - 77)

H. J. Hardon, The bases in the clay fraction of Indonesian soils (I - 78)

L. Bramao, J. C. Cady and S. B. Hendricks, The determination of halloysite and its use in the study of red soils (I - 79)

G. Waegemans et R. Vanderstappen, Authigenèse, altération des minéraux argileux et latéritisation dans les régions intertropicales (III)

11.00 a.m. *conclusions from discussions*

Section of Soil Conservation and Management

Tuesday, July 25th

- 9.15 a.m. *R. Bradfield, Soil structure* (II - 112)
11.00 a.m. } joint session with the Section of
2.30 p.m. } Land Classification and Evaluation

Wednesday, July 26th

- 9.15 a.m. *T. Wallace, Diagnosis of soil fertility by visual symptoms of crops* (I - 1)
11.00 a.m. *erosion and erosion control*
J. H. de Haan, Integral erosion research (I - 81)
D. A. Campbell, The effect of conservation management of watered grasslands in minimizing surface run-off (I - 82)
D. A. Campbell, Development of aerial topdressing of grassland as a conservation tool to minimize run-off (I - 84)
D. A. Campbell, Types of soil erosion in New Zealand (II - 173)
A. Reifenberg, Man made dune encroachment on Israel's coast (I - 83)
2.30 p.m. *C. E. Kellogg, Tropical soils* (I - 66)

Thursday, July 27th

- 9.15 a.m. *H. H. Bennett, Modern soil conservation* (I - 2)

Friday, July 28th

- 9.15 a.m. *L. Dudley Stamp, The classification and use and misuse of land* (I - 3)

Saturday, July 29th

- 9.15 a.m. *soil science and its applications in the Netherlands*

Monday, July 31st

- 11.00 a.m. *J. H. de Haan, Progress in shifting cultivation in Indonesia* (I - 80)
T. N. Jewitt, Shifting cultivation of the clay plains of the Central Sudan (I - 85)
J. S. Veenbos, Infiltration in peat soils (II - 174)

2.30 p.m. joint session with the Section of Land Classification and Evaluation

Tuesday, August 1st

9.15 a.m. joint session with the Section of Land Classification and Evaluation

11.00 a.m. conclusions from discussions



Section of Land Classification and Evaluation

Tuesday, July 25th

9.15 a.m. *R. Bradfield, Soil structure* (II - 112)

11.00 a.m. *classification for land use*

M. Gracanin, Typological investigations of vegetation and soil as a basis for land classification and evaluation (II - 176)

R. D. Hockensmith, Classifying land according to its capabilities (I - 89)

O. Tamm, Principles of classification of forest sites in Sweden by examination of the soil (I - 95)

J. V. Botelho da Costa, Land classification for land use planning by the Junta de Colonizaco Interna, Portugal (I - 96)

R. Smith, The classification of virgin lands from soil surveys, South Western Australia (I - 97)

G. Ekstrm, Soil classification in Scandinavia - Finland, especially in Sweden (II - 178)

L. I. Grange and P. W. Smallfield, Land classification, New Zealand (II - 179)

J. H. de Haan, Land classification in Indonesia (III)

C. Mantelet, Les plaines maritimes du Nord de la France (II - 181)

H. Egberts, The horticultural plan of settlement (II - 180)

W. J. van Liere, Land classification of Dutch soils, especially on behalf of horticulture (II - 177)

2.30 p.m. *classification for land use* (continued)

Wednesday, July 26th

9.15 a.m. *T. Wallace, Diagnosis of soil fertility by visual symptoms of crops* (I - 1)

11.00 a.m. *rating of soil productivity*

R. E. Storie, Rating soils for agricultural, forest and grazing use (I - 87)

G. R. Clarke, Productivity ratings (I - 90)

Th. J. Ferrari, Growth factors and soil productivity (I - 91)

L. de Leenheer et K. de Caestecker, Les récoltes expérimentales comme indice de fertilité: son application aux polders marins belges (I - 92)

J. Mitchell, Productivity ratings and their importance in the soil survey report (I - 93)

J. K. Ableiter and C. P. Barnes, Soil productivity ratings (I - 94)

J. K. Taylor, The classification of irrigation soils with reference to land use (II - 183)

L. de Leenheer and M. Simon, Influence of soil type on the production of sugar beets and sugar (II - 182)

L. de Leenheer, K. de Caestecker, H. Reyntens and A. Andries, Relation of soil types to the grass flora in meadows in the Belgian sea polders (II - 184)

2.30 p.m. *rating of soil productivity* (continued)

Thursday, July 27th

9.15 a.m. *H. H. Bennett, Modern soil conservation* (I - 2)

Friday, July 28th

9.15 a.m. *L. Dudley Stamp, The classification and use and misuse of land* (I - 3)

11.00 a.m. *R. K. Schofield, Soil moisture and evaporation* (II - 113)

2.30 p.m. *L. Gisiger, Grundsätzliche Fragen zur Bestimmung des Phosphorsäure- und Kalibedürfnisses auf Grund der chemischen Bodenuntersuchung* (I - 49)

Saturday, July 29th

9.15 a.m. *soil science and its applications in the Netherlands*

Monday, July 31st

9.15 a.m. *technical methods of classification*

L. de Leenheer et W. Welvaert, La caractérisation des profils pédologiques comme élément de classification des sols des polders marins belges (II - 186)

K. C. Hou and C. T. Tao, Telling soil characteristics by the use of plasticity curves (I - 88)

R. D. Hockensmith, Classifying land according to its capabilities (I - 89)

G. R. Clarke, Productivity ratings (I - 90)

L. de Leenheer et K. de Caestecker, Les récoltes expérimentales comme indice de fertilité: son application aux polders marins belges (I - 92)

L. de Leenheer and K. de Caestecker, Reliability of a quick field method to determine the productivity of different soil types for sugar beets (II - 185)

2.30 p.m. *basic problems of classification*

M. Gracanin, Typological investigations of vegetation and soil as a basis for land classification and evaluation (II - 176)

W. C. Visser, The trend of the development of land evaluation in the future (I - 86)

R. E. Storie, Rating soils for agricultural, forest and grazing use (I - 87)

J. K. Ableiter and C. P. Barnes, Soil productivity ratings (I - 94)

O. Tamm, Principles of classification of forest sites in Sweden by examination of the soil (I - 95)

W. C. Visser, The quantitative basis of the evaluation of soil productivity (I - 98)

D. Burger, Topological inertia and soil science (II - 175)

Tuesday, August 1st

9.15 a.m. *basic problems of classification* (continued)

11.00 a.m. conclusions from discussions

Section of Saline Soils

Tuesday, July 25th

9.15 a.m. *R. Bradfield, Soil structure* (II - 112)

11.00 a.m. *genesis and new formation*

R. Smith, Solonetz soils of the subhumid zone of South Western Australia (I - 101)

L. J. H. Teakle, An interpretation of some „solonized” (alkali) soils in south-western Western Australia (I - 102)

B. Gèze et E. Servat, Sur les sols salins d'origine continentale de la plaine Languedocienne (I - 103)

S. F. Kuipers, Gley phenomena in marine clay soils with a saltish subsoil (II - 187)

M. M. Elgabaly, Preliminary survey of the saline and alkaline soils of Egypt (II - 188)

2.30 p.m. *genesis and new formation* (continued)

Wednesday, July 26th

9.15 a.m. *T. Wallace, Diagnosis of soil fertility by visual symptoms of crops* (I - 1)

11.00 a.m. *F. E. Bear, Some soil organic matter relationships* (I - 25)

2.30 p.m. *C. E. Kellogg, Tropical soils* (I - 66)

Thursday, July 27th

9.15 a.m. *H. H. Bennett, Modern soil conservation* (I - 2)

Friday, July 28th

9.15 a.m. *L. Dudley Stamp, The classification and use and misuse of land* (I - 3)

11.00 a.m. *R. K. Schofield, Soil moisture and evaporation* (II - 113)

2.30 p.m. *management and reclamation*

M. R. Huberty and A. F. Pillsbury, Reclamation of saline soils in Coachella Valley, Calif. U.S.A. (I - 100)

H. W. Dougall, Factors concerned in the reclamation, poldering and fertility of certain riverain soils in Sierra Leone (II - 189)

J. Bordas, La mise en culture des sols salins de Camargue et l'extension de la riziculture française (II - 190)

E. Kivinen, Sulphate soils and their management in Finland (II - 191)

4.00 p.m. *chemical problems*

G. B. Bodman and M. Fireman, Changes in soil permeability and exchangeable cation status during flow of different irrigation waters (I - 104)

W. T. Mac George and W. H. Fuller, Relation between the Na:Ca ratio in the saturation extract and percentage sodium in the exchange complex (I - 105)

R. C. Roberts, Chemical effects of the salt-tolerant shrubs on soils (I - 106)

M. Y. Shawarbi, The status of phosphates in saline and alkaline soils with special reference to Egyptian soils (II - 192)

Saturday, July 29th

9.15 a.m. *soil science and its applications in the Netherlands*

Monday, July 31st

9.15 a.m. *reclamation of soils inundated with sea water*

B. Verhoeven, Soil moisture studies in view of salt movement control (III)

H. W. Dougall, A note on the reclamation of soils inundated with seawater (I - 107)

G. Deloffre, The leaching of chlorides in the regions of Dunkerque and Le Verdon, flooded with salt water in 1944 (I - 108)

C. van den Berg, The influence of salt in the soil on the yield of agricultural crops (I - 109)

G. Deloffre, Decline of structure of the soils flooded by salt water in 1944 in the region of Dunkerque (I - 110)

J. J. Westerhof, Restoration of the structure of inundated areas in the Netherlands (I - 111)

2.30 p.m. *L. A. Richards, Chemical and physical characteristics of saline and alkali soils of Western United States* (I - 99)

J. K. Basu, Problems of saline soils in the Bombay State, India (III)

Tuesday, August 1st

9.15 a.m. *conclusions from discussions*

SECTIONAL TABLE

	phys	clay	chem	biol	fert	trop	cons	class	sal
Tuesday July 25th	9.15 a.m. 11.00 a.m. 2.30 p.m.	plen (clay) ×	plen gen ×	plen (clay) ×	plen × gen	plen × × (biol)	plen × × (class) (class)	plen × ×	plen × ×
Wednesday July 26th	9.15 a.m. 11.00 a.m. 2.30 p.m. 4.00 p.m.	plen × × ×	plen gen × ×	plen (chem) × ×	plen (chem) × ×	plen × gen	plen × (trop)	plen × ×	plen (chem) (trop)
Friday July 28th	9.15 a.m. 11.00 a.m. 2.30 p.m. 4.00 p.m.	plen gen × ×	plen (phys) × (chem)	plen × (fert)	plen × gen ×	plen (phys) × ×	plen × (fert)	plen (phys) (fert)	plen (phys) ×
Monday July 31st	9.15 a.m. 11.00 a.m. 2.30 p.m. 4.00 p.m.	× × (sal) ×	× × × (sal)	gen × ×	(biol) × (sal) ×	(cons) × ×	gen × (class) (class)	×	×
Tuesday August 1st	9.15 a.m. 11.00 a.m.	{ (biol) × ×	×	×	×	×	(class)	×	×

× sectional meetings
() brackets refer to joint sessions with sections mentioned.
for abbreviations see page 12.

Wed. Open Bureau Hotel 17C

Monday PM - 2:30
for Sail Conference

of our experience, on behalf of
the lawyers & especially the
foreign governments, I wish to thank
you for your cordial and
thoughtful introduction. Clearly
you have given us a good start
on our work - now it is up to
us - I thank you sir.

now - the but we

need to know processes. But we get
many contributions - there are too, we work
at on the we work together!

What countries have national sail societies in
the sense of the rules?

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2) USA

3) France?

4) Holland

5) USSR

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 360 Güray, R., Halfweg, N.H.
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 412 Haasjes, Ir K. H. S., Utrecht
 443 Hagenzieker, F., Urambo, Tanganyika
 313 Hamilton, Dr R., Hilversum
 473 Hanraets, Ir J. M. J., Zwolle
 40 Hardon, Prof. Dr H. J., Utrecht
 96 Heiningen, Dr J. van, Amsterdam N.
 355 Hellinga, Prof. Ir F., Wageningen
 356 Hellinga—van der Werf, Mevrouw H.,
 Wageningen
 31 Hempenius, Mejuffrouw H., Groningen
 3 Hissink, Mejuffrouw Mr A. C., Amsterdam
 440 Hol, Mejuffrouw Prof. Dr J. B. L., Utrecht
 299 Hooghoudt, Dr S. B., Groningen
 32 Hudig, Prof. Ir J., Wageningen
 97 Huisman, Ir Ph. H., Amsterdam N.
 33 Huizinga, Ir T. K., 's-Gravenhage
 34 Huizinga—Grolman, Mevrouw C., 's-Gravenhage
 31 Insinger, Mejuffrouw L., Bussum
 156 Janse, A. R. P., Wageningen
 102 Jong, Ir J. J. de, Wageningen
 45 Kingma Boltjes—Kingma Boltjes, Mevrouw T.,
 Amsterdam
 444 Keulen, B. W. van
 521 Kloes, L. J. J. van der, Naaldwijk
 252 Kuile, C. H. H. ter, Ithaca, N. Y., U.S.A.
 450 Kuipers, Ir S. F., Bennekom
 163 Lange, Ir J. J. de, Amsterdam N.
 398 Lehr, Dr J. J., Wageningen
 479 Liere, Dr W. J. van, Wageningen
 403 Löhns, Mejuffrouw Dr M. P., Wageningen
 35 Maschhaupt, Ir J. G., Groningen
 101 Meer, Ir K. van der, Arnhem
 24 Middelburg, Dr H. A., Wageningen

- 509 Modderman, Dr P. J. R., Zeist
- 36 Mohr, Prof. Dr E. C. J., Hilversum
- 31 Mol van Otterloo, Mejuffrouw C. de, Amsterdam
- 490 Molen, W. H. van der, Kampen
- 154 Mulder, Dr D., Goes
- 22 Mulder, Dr E. G., Groningen
- 87 Muller, Dr F. M., Haren (Gr.)
- 328 Nieuwdorp, Dr W. A., Deventer
- 66 Nispen tot Pannerden, Jhr Ir J. van,
Well (Limburg)
- 98 Olphen, Drs M. van, Amsterdam N.
- 427 Ostendorf—Doyer, Mevrouw Dr C. M.,
Groningen
- 41 Paauw, Dr F. van der, Groningen
- 42 Paauw—Ubink, Mevrouw A. M. van der,
Groningen
- 188 Pannekoek, Dr A. J., Haarlem
- 20 Peerlkamp, Dr P. K., Groningen
- 357 Poll, Ir K., 's-Gravenhage
- 162 Pons, L. J., Wageningen
- 381 Pijls, Dr F. W. G., Bennekom
- 83 Redlich, Dr G. C., Zwolle
- 77 Roo, Ir H. C. de, Borger (Dr.)
- 18 Rowaan, Dr P. A., Groningen
- 19 Rowaan—Palm, Mevrouw M. A., Groningen
- 95 Schans, Ir R. P. H. P. van der, Bennekom
- 334 Scheepers, Ir C. P., Rotterdam
- 94 Schelling, Ir J., Zwolle
- 31 Schippers, Mejuffrouw A. C., Amsterdam
- 31 Schippers, Mejuffrouw B. J., Amsterdam
- 31 Schippers, Mejuffrouw H. C., Amsterdam
- 337 Schreven, Dr D. A. van, Kampen
- 448 Schroo, Ir H., Austerlitz (Zeist)
- 15 Schuffelen, Prof. Dr A. C., Wageningen
- 16 Schuffelen—Penders, Mevrouw A. M. E.,
Wageningen
- 28 Schuurman, Dr J. J., Groningen
- 488 Schuylenborgh, Dr J. van, Wageningen
- 483 Smet, L. A. H. de, Winschoten
- 99 Smits, Ir H., Kuinre
- 283 Staveren, Ir J. M. van, Zwolle
- 122 Stenvert, Ir M., IJmuiden
- 455 Steur, Ir G. G. L., Wageningen
- 148 Swaminathan, M. S., Wageningen
- 30 Swets, Ir A. W., Groningen
- 81 Teensma, Ir B., Amsterdam Z.
- 37 Tesch, Dr P., Haarlem
- 38 Thierry, Prof. Ir J. W., 's-Gravenhage
- 138 Veenenbos, Ir J. S., Heerenveen
- 527 Venema, Ir K. C. W., Haarlem
- 110 Verhoeven, Ir B., Ens (N.O. Polder)
- 111 Verhoeven—van der Zweep, Mevrouw I. J. C.,
Ens (N.O. Polder)
- 25 Vermaat, Ir J. G., Rotterdam

- 327 Vermeulen, Ir F. H. B., Groningen
 26 Visser, Ir W. C., Amersfoort
 27 Visser-Dalhuisen, Mevrouw W. E., Amersfoort
 261 Voort, Ir M. van der, Bogor (Buitenzorg),
 Indonesië
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 90 Weelden, Ir A. van, s-Gravenhage
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 258 Ayres, Mrs A. S., Honolulu, Hawaii
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 178 Bear, Mrs H. J., New Brunswick
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 259 Bonnet, Dr J. A., Puerto Rico
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 410 Clark, Mrs R. E., Ithaca, N.Y.
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 248 Cummings, Prof. Dr R. W., Raleigh, N. Car.
 255 Ferguson, Dr J. A., Urbana, Ill.
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- 281 Koehler, F. E., Columbia, Miss.
- 195 Krusekopf, Prof. H. H., Columbia, Miss.
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- 335 Obenshain, Prof. S. S., Blacksburg, Va.
- 173 Parks, Dr R. Q., Beltsville, Mld.
- 499 Powers Dr W. L., Corvallis, Oregon
- 324 Richards, Dr L. A., Riverside, Cal.
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- 146 Thorp, Mrs J., Lincoln, Nebraska
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- 517 Vandecaveye, Prof. Dr S. C., Pullman,
Washington
- 518 Vandecaveye, Mrs S. C., Pullmann, Washington
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- L. Kavic, Sarajevo
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- 220 W. E. Calton

NOTES

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Neelogg

**FOURTH INTERNATIONAL CONGRESS
OF SOIL SCIENCE
AMSTERDAM
1950**

GUIDE
TO THE
POST-CONGRESS EXCURSIONS
THROUGH THE NETHERLANDS
(AUGUST 2-12th 1950)



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OF SOIL SCIENCE**

AMSTERDAM

1950

GUIDE

**TO THE
POST-CONGRESS EXCURSIONS
THROUGH THE NETHERLANDS**

(AUGUST 2-12th 1950)



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PREFACE

This excursion-guide is intended as a key to the excursions in Holland which will be made on the occasion of the Fourth International Congress of Soil Science, Amsterdam, 1950. The day-programmes have in substance been prepared in co-operation with:

The Agricultural Experiment and Research Station and Institute for Soil Research, T.N.O. Groningen.

The Section for Soil Research, North Eastern Polder Reclamation, Kampen.

The Soil Survey Institute, Wageningen.

The Research Section of the Government Service for Drainage, Land Improvement and Reallocation, Utrecht.

To this excursion-guide there belongs a portfolio containing soil-maps of the areas to be visited.

Prof. Dr C. H. Edelman wrote a volume entitled: „Soils of the Netherlands”, Amsterdam 1950, in which a "Provisional Soil Map of the Netherlands" (1 : 400.000) has been included and in which mention has been made of the more general pedology of the Netherlands.

The contents of this guide are consequently more confined to short introductions and technical data.

The appellations of the soils and soil types have not yet been standardized in Holland, but the greatest difficulty is to select the correct English or American designations, because denominations that bear a close resemblance to each other, often appear to have a different signification. The translations of such terms is, therefore, not quite uniform. This will, however, not constitute a great drawback, as the excursionists will see the soils themselves.

When this guide was going to press all the detailed data were not yet known (inter alia: the soil-sample analyses). The latter will be distributed separately during the excursions.

The Post-Congress Excursion Committee:

C. H. EDELMAN, Chairman

C. BOSMAN

P. BRUIN

W. R. DOMINGO

W. C. VISSER

A. J. WIGGERS

A. J. ZUUR

P. BURINGH, Secretary

GENERAL INFORMATION

For nine days pedological excursions will be made by bus in different parts of Holland. The object of these is to demonstrate various Dutch soils and to get acquainted with the way in which soil research is carried out and what significance this has in Holland for different purposes.

The participators in the excursions will be shown round by Dutch pedologists. During the excursions the leaders will give full explanation in English and in French and answer any questions. This booklet serves as a guide, while it also contains many technical data.

Excursion-centres and groups

The participators in the excursions have been divided into three groups: A, B, C. All the excursions are made in the same group. A groupleader is in charge of each group.

Group A (red)

Group B (yellow)

Group C (blue)

The one-day excursions are made by bus. Three excursion-centres have been established from where excursions are made on three consecutive days.

Excursion-centre	Groningen	(excursions I, II and III)
„	„	Wageningen (excursions IV, V and VI)
„	„	Breda (excursions VII, VIII and IX)

On Wednesday, August 2, the three excursion-groups will be taken to each of these towns.

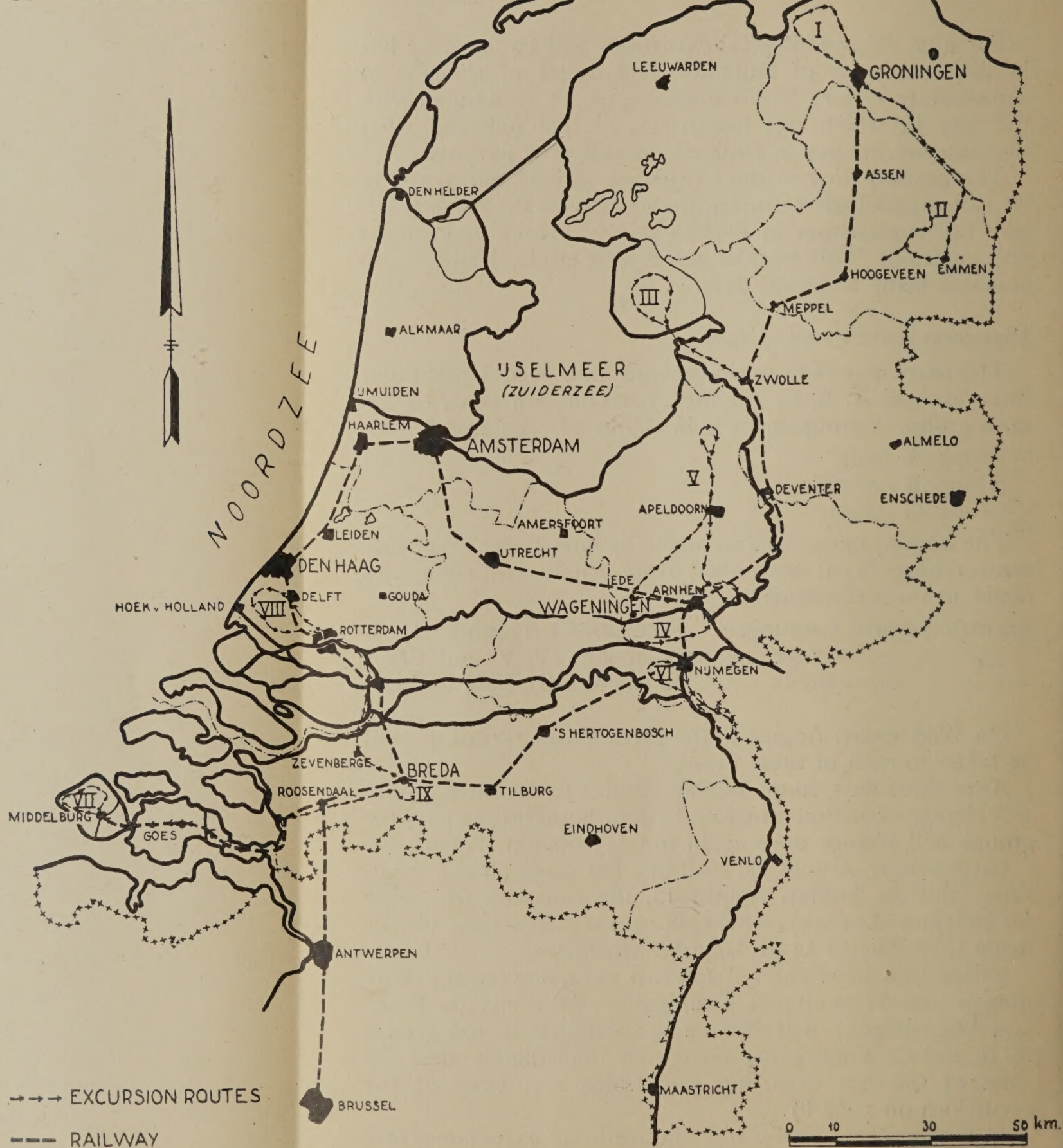
After three days, so on Sunday, August 6, the three groups will change excursion-centre and after another three days the groups will change once again (on Wednesday, August 9).

On Saturday, August 12, each one has made all the excursions, and on Sunday, August 13, the company will leave for Belgium (Brussels), where six one-day excursions will be made from August 14 to August 19 inclusive.

Those who have entered for two excursion-centres (Groningen and Wageningen, Groningen and Breda or Breda and Wageningen) will also be incorporated in the groups A, B, and C. Their programme ends immediately after the close of the last excursion (for which see: close of the excursions on page 9).

In Holland each group will sojourn in an excursion-centre

GENERAL MAP OF THE EXCURSIONS



for three days. Every time the group is split up into three parts and each part makes a different excursion each day. After three days one will consequently have made all the three excursions starting from a definite centre. In each excursion-centre a local leader will be available. The excursion-leaders in the motor-buses will always make the same excursions.

Guidance

As regards information and questions, participators may always apply to their groupleader, who makes the whole excursion with them. They may also apply to the local leader or to those who are in charge of the bus-excursions. The names of the leaders have been stated under the heading: technical data (page 11).

Conveyance

As a rule the participators in the excursions will be taken to the excursion-centres by train and per group. The conveyance from one centre to another will also take place by train. The seats in the trains are reserved.

The excursions proper are made by bus; place and hour of departure may be found in the day-programmes, or will be made known in time.

Luggage

All participators may take their luggage along with them to the excursion-centres, where every one will stay at the same hotel for a few days. Each participator is allowed to take two suit-cases at most. In Amsterdam labels will be distributed, which should be fastened to the luggage. The labels for group A are red, for group B yellow, and for group C blue. On each label the congress number and the name should be written distinctly in block-letters.

In the excursion-programme it has been indicated for each group (group A on page 15, group B on page 21, group C on page 23) in what way the luggage will be conveyed each time. This guide should not be packed with your luggage, but kept at hand every day in your pocket or bag. The annexes to this guide may be left behind at the hotel, taking only the maps that are wanted on the day of the excursion.

Insurance

During the excursions in Holland all participators are insured against accidents with the European Insurance Company Limited to an amount of one thousand guilders (f 1.000,—) per person.

Accommodation, breakfast, lunch, dinner

For all participators rooms have been booked at hotels in the three centres. Breakfast is taken at your own hotel. During the excursions an interval of about an hour and a half is held, during which lunch is taken in one of the small towns or villages along the excursion-route.

Dinner will be served at your own hotel after return from the excursion in the excursion-centre.

In connection with the limited hotel accommodation at Wageningen, consequent of the heavy damage caused here during the war, participators in the excursions will in the main stay with private families and be accommodated in students' rooms. Dinner will be partaken of together at the Students' Clubhouse "Ceres", where a lounge and a refreshment-room have been fitted up.

Division of the day

Most excursions will commence at 8.30 a.m. (for which see the detailed programmes for groups A, B, and C). All participators are requested to be present at the indicated places in time. The excursion-programme is not overcrowded, so that there is plenty of time to inspect everything quietly. The excursion-leaders will see to the explanation. The excursions are made in such a way that participators will be back in the centre of excursion at about 5 p.m. If desired, purchases may still be made in town, for the shops do not close until 6 p.m.

After dinner the evening may be spent together in a pleasant way at one of the hotels. The local leaders will be able to comply with many of your wishes.

Payment

All participators will receive coupon-books from the Congress-bureau in Amsterdam, by means of which accommodation, breakfast, lunch, and dinner may be paid for during the excursion, attendance being included. It is clearly indicated on each coupon for what purpose it may be used. Convince yourself of it that every time the right vouchers are torn out!

All the other things ordered should be paid for by the participators themselves and it is advisable to settle these at once with the attending staff.

In case of difficulties, please apply to one of the leaders. A list of coins and bank-notes may be found on page 107 of this guide.

Cancellation and changing

All participators in the excursions have been incorporated in one of the three groups so that everybody's wishes have been duly considered. In view of the intricate organization, it will not be possible to make any changes in this.

If one does not keep close to the original statement on the entry-form and withdraws from the excursion or part of it, one will have to refund the expenses connected with it. Please consult the Congress-bureau, Amsterdam, about this matter.

He who wishes to break off the excursion prematurely, will not be entitled to claim back the excursion-fee already paid.

Close of the excursions

Those who have entered for *one excursion* (only Groningen, or Wageningen, or Breda) will terminate this excursion on *Saturday, August 5*, after return in the excursion-centre at about 5 p.m. Any expenses made after this date and hour are for own account. The groupleader or local leader will gladly help you as to booking at the railway-station etc.

Those who have entered for *two excursions* (Groningen and Wageningen, Groningen and Breda, or Wageningen and Breda) will terminate their excursion on *Wednesday, August 9*, in the afternoon of that day's excursion after return in the excursion-centre. In connection with the interchange of excursion-centre, these excursions will come to an end at about 2 p.m. The person whose excursion has entirely come to an end, may, of course, go wherever he or she likes, while from that moment any expenses will be for his or her account.

Those who have entered for *three excursions* and who *have not entered for the trip to Belgium*, terminate their excursion on *Saturday, August 12*, after return from that day's excursion in the excursion-centre, that is at abt. 5 p.m. One is now at liberty to go wherever one likes, while any expenses are for one's own account from that moment.

Those who have entered for *three excursions* and who *will go to Belgium afterwards*, have all been incorporated in group A. On *August 12*, those persons will be at Breda where they will stay the night. On *Sunday, August 13*, they will set out on the journey to Belgium (Brussels) by bus at about 9 a.m.

Be always in time!

The excursion-committee requests any participator to be

always present in time (about 10 minutes before departure) at the places indicated.

Changes, if any, will be made known in good time. The excursion-committee do not assume any responsibility as to prejudices resulting from being late at the places agreed upon.

TECHNICAL DATA

Group-leaders:

Group A: Prof. Dr J. P. Bakker, Amsterdam.

Group B: Ir G. de Bakker, The Hague.

Group C: Prof. Ir F. Hellinga, Wageningen.

Local leaders in the excursion centres:

Groningen: P. Bruin (Zwolle: A. J. Zuur).

Wageningen: D. C. Doeglas.

Breda: J. S. Veenenbos.

Excursion centre Groningen

Local committee of the centre Groningen:

P. Bruin chairman at Groningen.

A. J. Zuur chairman at Zwolle.

Social Centre in hotel Willems, 52 Heerestraat.

Hotels:

Hotel Friesland, 4 Kleine Pelsterstraat, tel. K. 5900 - 20637.

Hotel Willems, 52 Heerestraat, tel. K 5900 - 23741.

Hotel Frigge, 72 Heerestraat, tel. K 5900 - 29215.

Hotel Hofman, 12 Poelestraat, tel. K 5900 - 29841.

Hotel de Doelen, 36 Grote Markt, tel. K 5900 - 27041.

Zwolle

Social Centre in Hotel Gijtenbeek, Stationsplein, Zwolle,
tel. K 5200 - 7741.

Hotels:

Hotel du Commerce, 1 Voorstraat, tel. K 5200 - 6430.

Hotel Derboven, 26 Nieuwe Veemarkt, tel. K 5200 - 6351.

Hotel Frisia State, 7 Ruiterslaan, tel. K 5200 - 6017.

Hotel Goedhart, 13 Terborgstraat, tel. K 5200 - 6600.

Hotel Gijtenbeek, Stationsplein, tel. K 5200 - 7741.

Hotel de Kroon, 3 Voorstraat, tel. K 5200 - 5235.

Hotel Wientjes, 7 Stationsweg, tel. K 5200 - 5612.

Excursions in the centre Groningen

Excursion Groningen I

Marine clay soils.

Land reclamation works in the Lauwerszee.

Pumping station „Electra”.

The Institutions at Groningen.

Lunch at Groningen, Restaurant „Boshuis”, 95 Hereweg, tel. K 5900 - 20817.

Programme see page 27.

Excursion Groningen II

Experimental farm at Borgercompagnie.

The excavation of the peat and the reclamation of the land.

Some realloftment objects in Drenthe.

Lunch at Emmen, hotel Grimme, tel. 2.

Programme see page 36.

Excursion Groningen III

Landreclamation in the Zuiderzee region.

Process of maturation in the soil.

Soils of the Kampereiland.

Lunch at Emmeloord, Restaurant „De Beurs”.

Programme see page 52.

Excursion centre Wageningen

Local committee of the centre Wageningen: D. C. Doeglas, chairman.

Social Centre: Student Club-house „Ceres” Rijksstraatweg 1, tel. K 8370 - 2812.

Excursions in the centre Wageningen

Excursion Wageningen IV

Riverclay soils in relation to fruitgrowing.

Lunch at Hotel Veilings Vereniging Over-Betuwe at Elst, tel. K 8809 - 205.

Programme see page 69.

Excursion Wageningen V

Forest and heath-soils of the Veluwe.

Lunch at Apeldoorn, hotel Bloemink, near the Royal Palace, tel. K 6760 - 4141.

Programme see page 77.

Excursion Wageningen VI

Soil formation and different stages of weathering on river deposits of different age.

Visit to the Laboratory for Agricultural Chemistry, Wageningen.

Lunch at Wijchen, hotel „De Kroon”, Markt.

Programme see page 83.

Excursion centre Breda

Local Committee of the Centre Breda: J. S. Veenenbos, chairman.

Social Centre: Hotel de Kroon, 28 Bosstraat, tel. 8491.

Hotels:

Hotel de Kroon, 28 Bosstraat, tel. 8491.

Oranje Hotel, 7 Stationsplein, tel. 7647.

Hotel Mastbos, 20 Kerstenlaan, tel. 9406.

Hotel Dennenoord, 96 Duivelsburglaan, tel. 8790.

Hotel de Schuur, 17 Catharinastraat, tel. 8329.

Hotel du Commerce, 24 Grote Markt, tel. 8266.

Excursions in the centre Breda

Excursion Breda VII

Restauration of the sea clay soils of the isle of Walcheren after the salt water inundation of 1944-1945.

Lunch at Domburg, hotel „Walcherense Dolfijn”, Markt, tel. K 1188 - 215.

Programme see page 90.

Excursion Breda VIII

Various Westland soils in connection with intensive horticulture.

Lunch at Poeldijk, hotel Verburgh, tel. K 1749 - 3209.

Programme see page 96.

Excursion Breda IX

Agriculture and horticulture on wet and dry sandy soils.

Lunch at Princenhage, hotel Lips.

Programme see page 101.

EXCURSION-PROGRAMME FOUR GROUP A

Group-leader: Prof. Dr J. P. Bakker.

WEDNESDAY, AUGUST 2nd

Meeting-place: the Dam in Amsterdam at 1.45 p.m.

Departure: at 2 p.m. by bus to Groningen.

Luggage: excursionists should take their luggage along with them to the Dam. It will then be conveyed separately to Groningen.

Route: via the province of North Holland along the Damming Dike and via Leeuwarden to Groningen.

Leadership: several leaders of the excursions Groningen I and II.

During the drive a short description will be given of the various landscapes, the impolder-operations of the former Zuyder Zee (Wieringermeer) and the Damming Dike.

Arrival at Groningen at 6 p.m. During the bus-ride it will be made known where the party will be accommodated. Every excursionist will be taken to the hotel.

Dinner at the hotel.

The excursionists will be placed in the groups A 1, A 2 and A 3.

THURSDAY, AUGUST 3rd

GROUPS A 1 and A 2 will make the excursion Groningen I.

Departure: at 7 a.m., meeting-place will be made known.

Afternoon: a visit will be paid to the Institutes.

Dinner: at the excursionists' own hotel.

GROUP A 3 will make the excursion Groningen II.

Departure: at 8 a.m., place will be made known.

Dinner: at the excursionists' own hotel after return at Groningen.

FRIDAY, AUGUST 4th

Before departure excursionists are requested to get their luggage ready, for it will be taken to the hotels at Zwolle.

GROUPS A 1 and A 2 will make the excursion Groningen II.

Departure: at 8 a.m., place will be made known.

At the end of the excursion the motor-buses will ride on to Zwolle.

Dinner: at the hotel at Zwolle.

GROUP A 3 will make the excursion Groningen I.

Departure: at 7.15 a.m., place will be made known.

Afternoon: a visit will be paid to the Institutes, then by train from Groningen to Zwolle. Departure of train at 4.38 p.m., arrival at Zwolle at 5.52 p.m.

Dinner: at Zwolle.

SATURDAY, AUGUST 5th

The GROUPS A 1, A 2, and A 3 will make excursion Groningen III across the North-east Polder and Kamper-eiland.

Departure: at 8.30 a.m., place will be made known.

Dinner: after return from the excursion at Zwolle at the excursionists' own hotel.

SUNDAY, AUGUST 6th

Till lunch, excursionists are at liberty to go where they please.

Place and commencement of divine services will be made known.

Lunch: at excursionists' own hotel.

Departure of group A from Zwolle to Wageningen by train, luggage to be taken.

Meeting-place: in front of the railway station Zwolle at 2.30 p.m. Departure of train to Arnhem at 2.50 p.m.

Arnhem arrival at 4.21 p.m. Near exit buses will be held in readiness for ride to Wageningen (bus-ride of about 20 min.).

Arrival at Wageningen near the Students' Club-House „Ceres”.

Dinner at Students' Club-house „Ceres”, 1 Rijkstraatweg, Wageningen.

GROUP A will again be sub-divided into three groups, viz. A 1, A 2 and A 3.

In the evening excursionists will be taken to the students' apartments where accommodation will be had.

Breakfast and dinner will be served at the Students' Club-house „Ceres”. Excursionists are, of course, at liberty to spend the evening sociably at this Club-house.

MONDAY, AUGUST 7th

Breakfast: at 7.45 a.m. at the Students' Club-house „Ceres”.

Departure: at 8.30 a.m. by bus from the Students' Club-house „Ceres”.

GROUP A 1 will make the excursion Wageningen IV

GROUP A 2 „ „ „ „ „ V

GROUP A 3 „ „ „ „ „ VI

Dinner: at 6 p.m. after return at Wageningen in the Students' Club-house „Ceres”.

TUESDAY, AUGUST 8th

Breakfast: at 7.45 a.m. at „Ceres”.

Departure: at 8.30 a.m. by bus from „Ceres”.

GROUP A 1 will make the excursion Wageningen V

GROUP A 2 „ „ „ „ „ VI

GROUP A 3 „ „ „ „ „ IV

Dinner: at 6 p.m. after return at Wageningen at the Students' Club-house „Ceres”.

WEDNESDAY, AUGUST 9th

Today all excursions will be terminated after lunch. The afternoon excursions will be cancelled, excursionists will be taken to the centre: Breda.

Luggage: excursionists are requested to take their luggage along with them in the morning. The excursion leader will see to the luggage being conveyed to Breda.

Breakfast: at 7.45 a.m. at the Students' Club-house „Ceres”.

Departure: at 8.30 a.m.

GROUP A 1 will make the excursion Wageningen VI.

After lunch the excursionists will ride to the railway station of Nimeguen (Nijmegen), from there by train to Breda.

GROUP A 2 will make the excursion Wageningen IV.

After lunch the excursionists will ride to the railway station of Nimeguen, from there by train to Breda.

GROUP A 3 will make the excursion Wageningen V.

After lunch the excursionists will ride to the railway station of Nimeguen, from there by train to Breda.

Departure of train from Nimeguen at 4.04 p.m.

Arrival at Breda at 5.36 p.m.

Excursionists will be taken to their hotels.

Dinner at the hotel at Breda.

Excursionists of group A will again be placed in three groups: A 1, A 2, and A 3.

In the evening Ir Franke will deliver a lecture and a film will be shown about the restoration of the island of Walcheren.

THURSDAY, AUGUST 10th

GROUP A 1 will make the excursion Breda VII, will go by train from Breda to Middelburg where buses will be held in readiness in front of the railway station.

Departure of train from Breda at 8.38 a.m., arrival at Middelburg at 10.04 a.m.

At the end of the excursion Walcheren by train from Middelburg to Breda. Departure from Middelburg at 4.32 p.m., arrival at Breda at 6.06 p.m.

GROUP A 2 will make excursion Breda VIII, departure by bus at 8.30 a.m.

GROUP A 3 will make excursion Breda IX, departure by bus at 8.30 a.m.

Dinner after return at Breda at the hotel.

FRIDAY, AUGUST 11th

GROUP A 1 will make excursion Breda VIII, departure by bus at 8.30 a.m.

GROUP A 2 will make excursion Breda IX, departure by bus at 8.30 a.m.

GROUP A 3 will make excursion Breda VII, and leave by train for Middelburg where buses will be held in readiness in front of the railway station. Departure of train from Breda at 8.38 a.m., arrival at Middelburg at 10.04 a.m.

At the end of the excursion by train from Middelburg back to Breda. Departure from Middelburg at 4.32 p.m., arrival at Breda at 6.06 p.m.

Dinner after return at Breda at excursionists' own hotel.

SATURDAY, AUGUST, 12th

GROUP A 1 will make the excursion Breda IX, departure by bus at 8.30 a.m.

GROUP A 2 will make the excursion Breda VII and leave by train for Middelburg where buses are held in readiness in

front of the railway station. Train leaves Breda at 8.38, arrival at Middelburg at 10.04 a.m.

At the end of this excursion, by train from Middelburg back to Breda. Departure from Middelburg at 4.38 p.m., arrival at Breda at 6.06 p.m.

GROUP A 3 will make the excursion Breda VIII, departure by bus at 8.30 a.m.

After this the excursion will end for those who do not go to Belgium.

For the *participators in the excursion to Belgium*. Dinner and accommodation at excursionists' own hotel at Breda.

SUNDAY, AUGUST 13th

Departure by bus from Breda to Belgium at about 8.30 a.m.

The participators are taken to the frontier, where they will be received by the Belgian excursion-committee.

Lunch at Brussels.

EXCURSION-PROGRAMME FOR GROUP B

Group-leader: Ir G. de Bakker.

WEDNESDAY, AUGUST 2nd

Meeting-place: in front of the Central railway station at Amsterdam at 2 p.m. Excursionists are requested to take their luggage along with them.

Departure by train to Ede-Wageningen at 2.33 p.m.

Leadership: several excursion-leaders from the excursion-centre Wageningen.

Arrival at Ede-Wageningen Station at 3.38 p.m.

In the square at the south side buses will be held in readiness for taking the excursionists to Wageningen in 10 minutes and to the Students' Club-house „Ceres”. Here the excursionists will breakfast and dine every day. The evenings may be spent here sociably together.

Dinner at the Students' Club-house „Ceres”, 1 Rijksstraatweg. Excursionists will be placed in excursion-groups B 1, B 2 and B 3.

The students' rooms will be the sleeping-quarters for the excursionists.

THURSDAY, AUGUST 3rd

Breakfast at „Ceres” at 7.45 a.m.

GROUP B 1 will make the excursion Wageningen IV

GROUP B 2 „ „ „ „ „ V

GROUP B 3 „ „ „ „ „ VI

Dinner at „Ceres”.

FRIDAY, AUGUST 4th

Breakfast at „Ceres” at 7.45 a.m.

Departure at 8.30 a.m.

GROUP B 1 will make the excursion Wageningen V

GROUP B 2 „ „ „ „ „ VI

GROUP B 3 „ „ „ „ „ IV

Dinner at „Ceres”.

SATURDAY, AUGUST 5th

Breakfast at „Ceres” at 7.45 a.m.

Departure at 8.30 a.m.

GROUP B 1	will make the excursion Wageningen	VI
GROUP B 2	„ „ „ „ „	IV
GROUP B 3	„ „ „ „ „	V

Those excursionists who only take part in the excursions at Wageningen will end the excursions at Wageningen at 5 p.m.

EXCURSION-PROGRAMME FOUR GROUP C

Group-leader: Prof. Ir F. Hellinga.

WEDNESDAY, AUGUST 2nd

Meeting-place: in front of the Central railway station at Amsterdam at 2.30 p.m. Excursionists are requested to take their luggage along with them.

Departure by train to Breda at 3.12 p.m.

Leadership: several excursion-leaders from the excursion-centre Breda.

Arrival at Breda at 5.22 p.m.

Dinner at the hotels at Breda.

In the evening a lecture by Ir A. Franke, while a film will be shown about the restoration of the island of Walcheren.

The whole group will be split up into groups: C 1, C 2, and C 3.

THURSDAY, AUGUST 3rd

GROUP C 1 will make the excursion Breda VII. Departure of train to Middelburg at 8.38 a.m. Arrival at Middelburg at 10.04 a.m. In front of the railway station buses will be held in readiness.

At the end of the excursion departure by train to Middelburg at 4.32 p.m.

Arrival at Breda at 6.06 p.m.

GROUP C 2 will make excursion Breda VIII by bus, departure at 8.30 a.m.

- GROUP C 3 will make excursion Breda IX by bus, departure at 8.30 a.m.

Dinner at Breda at the end of the excursions.

FRIDAY, AUGUST 4th

GROUP C 1 will make excursion Breda VIII by bus, departure at 8.30 a.m.

GROUP C 2 will make excursion Breda IX by bus, departure at 8.30 a.m.

GROUP C 3 will make excursion Breda VII, departure by train to Middelburg at 8.38 a.m. Arrival at Middelburg

at 10.04 a.m. Excursion-buses will be held in readiness in front of the railway station.

At the end of the excursion back by train from Middelburg. Departure to Breda at 4.32 p.m. Arrival at 6.06 p.m.

Dinner at Breda.

SATURDAY, AUGUST 5th

GROUP C 1 will make the excursion Breda IX by bus, departure at 8.30 a.m.

GROUP C 2 will make the excursion Breda VII, departure by train to Middelburg at 8.38 a.m. Arrival at Middelburg at 10.04 a.m. Excursion-buses will be held in readiness in front of the railway station.

At the end of the excursion back by train to Middelburg, departure to Breda at 4.32 p.m. Arrival at 6.06 p.m.

GROUP C 3 will make the excursion Breda VIII, departure by bus at 8.30 a.m.

SUNDAY, AUGUST 6th

During the morning excursionists are at liberty to go where they please. Commencement and place of divine services will be made known.

Lunch will be handed to excursionists in the form of a lunch-parcel at the hotels.

The whole group will leave for Groningen.

Meeting-place: in the square in front of the railway station at 11.30 a.m.

Departure of train at 12.08 p.m. The journey will be via Nimeguen and Zwolle to Groningen. Arrival at Groningen at 5.40 p.m.

Dinner at the hotels at Groningen.

The whole group will be split up into groups C 1, C 2 and C 3.

MONDAY, AUGUST 7th

GROUP C 1 and GROUP C 2 will make excursion Groningen I. Departure by motor-bus at 7.30 a.m. Place will be made known later on.

Afternoon: visit to the Institutes.

GROUP C 3 will make excursion Groningen II, departure by bus at 8 a.m. Place will be made known.

Dinner after return at the hotels at Groningen.

TUESDAY, AUGUST 8th

Excursionists are requested to take their luggage along with them; it will be sent on to Zwolle separately.

The GROUPS C 1 and C 2 will make the excursion Groningen II. Departure at 8 a.m. At the end of the excursion the buses will ride on to Zwolle.

GROUP C 3 will make the excursion Groningen I. Departure by bus at 8 a.m. In the afternoon a visit will be paid to the Institutes and by train from Groningen to Zwolle. Departure at 4.38 p.m. Arrival at Zwolle at 5.52 p.m.

Dinner at the hotels at Zwolle.

WEDNESDAY, AUGUST 9th

The GROUPS C 1, C 2 and C 3 will all make the excursion Groningen III. Departure at 8.30 a.m. by bus from Zwolle.

GROUP C 2 will make the whole excursion, dine and stay the night at Zwolle. On Thursday, August 10th, they will leave Zwolle for the excursion Wageningen V.

The GROUPS C 1 and C 3 will make the excursion Groningen III till and inclusive of lunch. The afternoon programme is cancelled. The return-journey to Zwolle will take place by bus. Excursionists will fetch their luggage and leave by train from Zwolle to Wageningen at 2.50 p.m. Arrival at Arnhem at 4.18 p.m. In front of the railway station buses will be held in readiness to take the excursionists from Arnhem to Wageningen (about 20 min.). The two groups C 1 and C 3 will dine at the Students' Clubhouse „Ceres”, where the evening may be spent sociably together. The Students' rooms will be the excursionists' sleeping-quarters.

THURSDAY, AUGUST 10th

GROUP C 2 are still at Zwolle, after breakfast the excursionists will have to take their luggage along with them. Their luggage will be conveyed to Wageningen by train. Excursionists will leave Zwolle by bus at 8.30 a.m. and will be taken to Epe from where a start will at once be made with the first excursion-point of excursion Wageningen V. At the end of the excursion participators will arrive at Wageningen.

The GROUPS C 1 and C 3 will have breakfast at the Students' Club-house „Ceres” at 7.45 a.m. Then departure by bus at 8.30 a.m.

GROUP C 1 will make the excursion Wageningen IV
 GROUP C 3 „ „ „ „ „ VI
Dinner at „Ceres”, Wageningen.

FRIDAY, AUGUST 11th

All will have breakfast at „Ceres” at 7.30 a.m.
Departure at 8.30 a.m.

GROUP C 1 will make the excursion Wageningen V
 GROUP C 2 „ „ „ „ „ VI
 GROUP C 3 „ „ „ „ „ IV
Dinner at „Ceres”, Wageningen.

SATURDAY, AUGUST 12th

Breakfast at „Ceres” at 7.45 a.m. Excursionists are requested to take their luggage along with them.

Departure at 8.30 a.m.

GROUP C 1 will make the excursion Wageningen VI
 GROUP C 2 „ „ „ „ „ IV
 GROUP C 3 „ „ „ „ „ V

All excursions will be terminated after lunch, upon which the excursionists who will travel on to Belgium will be taken to Breda.

After lunch the excursionists will be taken to Nimeguen (Nijmegen) by bus. Departure by train from Nimeguen to Breda at 4.40 p.m. Arrival at Breda at 5.36 p.m. Dinner at Breda. Accommodation at Breda.

If there are many participators who do not travel on to Belgium, one or two buses will make the normal day-excursion, which will then end at Wageningen at about 5 p.m.

Excursionists will then be at liberty to go where they please.

EXCURSION GRONINGEN I

NORTHERN GRONINGEN

Subjects:

- a. land reclamation works in the Lauwerszee,
- b. marine clay soils,
- c. the Pumping Station „De Waterwolf”.

References:

- a. CAREY and OLIVER (1918) — Tidal lands — Glasgow.
REINHOLD, TH. (1949) — Over het mechanisme der sedimentatie op de Wadden (On the mechanism of sedimentation on tidal flats; with Summ.) — Meded. Geol. Stichting, Nieuwe Serie, No. 3.
WESTHOFF, V. (1947) — The vegetation of dunes and salt marshes in the Dutch islands of Terschelling, Vlieland and Texel — 's Gravenhage.
WESTKÜSTE: Archiv für Forschung, Technik und Verwaltung im Marsch und Wattenmeer (1938 —) — Heide i. Holst.
- b. HISSINK, D. J. (1935) — De bodemkundige gesteldheid van de achtereenvolgens ingedijkte Dollardpolders. (Soil conditions in the Dollardpolders) — 's-Gravenhage.
MASCHHAUPT, J. G. (1948) — Bodemkundige onderzoeken in het Dollardgebied (Soil Survey in the Dollard-Area; with Summ.) — 's-Gravenhage.
EDELMAN, C. H. (1950) — Soils of the Netherlands, Amsterdam.
- c. VEEN, JOH. v. (1948) — Dredge, Drain and Reclaim — 's-Gravenhage.

Appendixes:

- Map 1, The land reclamation works in the provinces of Groningen and Friesland.
- Map 2, The percentages of clay fraction in the top layer of two young polders in the province of Groningen.

Route map (fig. 2).

Excursion under the guidance of: Th. J. FERRARI, J. VAN DER HAM, L. F. KAMPS, A. J. WIGGERS.



Fig. 2. Route map

Departure:

Owing to the difference in times of low tide, the hours of departure are as follow:

3 Aug. at 7.00 a.m.

4 Aug. at 7.15 a.m.

7 Aug. at 7.30 a.m.

8 Aug. at 8.00 a.m.

10 Aug. at 1.30 p.m.

11 Aug. at 0.30 p.m.

Lunch at Groningen, Restaurant „Boschhuis”.

After or before the lunch a visit will be paid to the following Institutes at Groningen:

The Agricultural Experiment Station and Institute for Soil Research T.N.O. (van Hallstraat).

The Soil Testing Laboratory, Groningen.

EXCURSION PROGRAMME

Introduction

Roughly speaking the sea-clay of the province of Groningen may be divided into an older and a younger phase of the

young sea-clay. The older marine clay, mostly heavy and not containing any calcium carbonate, dates from the beginning of this era.

This first inhabitants of the sea-clay area protected themselves against inundations by building dwelling-mounds (terps). The first construction of these had already begun a few centuries before the beginning of this era.

In the course of time large parts of the older clay area fell a prey to the sea again. Remains of this old area are still found as the nucleus of the sea-clay area of Groningen. Consequently these remains are characterized by the presence of terps in the midst of heavy, tough clay soil that is almost impervious to water and contains no calcium carbonate. These tracts are almost exclusively used as grassland. Along the borders and in inlets of this old clay area, large parts of land have again been recovered from the sea (younger sea-clay). Especially in inlets of the coast much new land has sometimes been reclaimed in a comparatively short time.

In Groningen since the 13th century a total of nearly 64.000 hectares of land have been reclaimed, from which the young, light, calcareous clay soils and sandy clay soils have originated.

On the way to Zoutkamp one gets an idea of the various polders which, since 1400, have been laid out in the originally very wide mouth of the river Lauwers.

Owing to the fact that most inlets have silted up and the coast-line has got a less indented form, but perhaps also because the main sea-level has shown a general rise in relation to the land, natural alluvion is practically out of the question nowadays.

When land has to be reclaimed along the Frisian and the Groningen coast at present man must lend a helping hand to nature. Accordingly this has regularly taken place during the last few centuries, i.e., by means of the so-called trenching-system, which was put into practice by the owners of the beaches. During the periods in which there was little work to be done by the labourers on the farms, these proprietors had trenches dug at right angles to the coast at intervals varying from 5 to 10 metres in the sea-bottom near the coast, emerging at low tide. The soil from the trenches was spread out on the intervening plots. The trenches having silted up, this process was repeated, till, in course of time, the ground level came to lie above normal high tide, got covered with grass and could be utilized as pasture.

Between the north coast of Friesland and Groningen and the Frisian Islands there is a shallow sea, called the Wadden

Sea. The bottom of this Wadden Sea consists of sand-banks which for the greater part are dry at low tide. If an attempt were made to impolder these Shallows in a way corresponding to that of the Zuiderzee, a barren sandy plain would be the result, almost completely unsuitable for agriculture.

The water from the muddy shallows contains, however, particles of clay which, together with fine sand are deposited in places where conditions are favourable.

By the Lamellibranchiates, living in large numbers on the Dutch Shallows, the particles of clay are taken up in a finely divided state along with the food, and after having passed through the alimentary canal, they are excreted as conglomerations of much bigger size, in consequence of which the rate of settling of the clay is increased considerably. When the weather is calm these particles of clay subside on the flats, but when the weather gets rough, they are moved by the water and are, *inter alia*, deposited on the settling-basins, laid out for the purpose all along the coast (Map 1).

Besides the Government, some Coastal Polder Boards, the Provincial Board of the province of Groningen, and a few private persons are engaged in land reclamation. At present the Ministry of Public Works are applying the so-called improved Schleswig-Holstein system, consisting in the construction of clay dams and dams made of rows of wooden piles with a filling of brushwood in between. In this way, settling-basins of about 400 by 400 metres are formed (see Map 1). Inside these basins a system of ditches and trenches is laid out. The dams check the dash of the waves and the ditches and trenches bring about the regular influx and reflux of the water. The plots between the trenches get fairly well drained at low tide in consequence of which the settled silt is able to bind to the soil and is not immediately washed away. Once or what is even better, twice a year the silt has to be removed from the trenches; the dug soil is also spread on the adjoining plots.

Since 1948 mechanical trenching has been applied to some grounds along the Groningen coast; this is carried out by means of ploughs drawn by powerful caterpillar-tractors.

This working method is, however, only possible during the initial stage of land reclamation (when the soil is still rather hard and sandy) and during the final stage (when the silted-up soils have become more consistent). During the intermediate stages the fields are mostly too soft and inaccessible to tractors.

The soil within the settling-fields rises. Roughly calculating, the rate of accretion is 5 to 10 cm a year, but there

are appreciable local differences in this respect.

On the rising grounds, vegetation gradually makes its appearance, which in its turn also promotes silt-catching.

First of all diatoms and tiny sea-weeds, living at the bottom, play an important part in the process of fixing the material. Covered by a fresh, little layer of sediment, they creep upwards, thus embedding and protecting the sediment. The following species are particularly worth mentioning: *Salicornia herbacea*, *Aster Tripolium* and *Glyceria maritima*. This latter plant is a perennial grass and produces dense sods; it is, therefore, of great importance for land reclamation.

The species of grass, known as: *Spartina Townsendii*, imported from the south of England, was formerly planted out and sown on a fairly large scale along the Frisian-Groningen coast.

Probably due to climatic conditions, its viability has proved to be deficient along the Groningen coast, and its importance as a clay- and sandcatcher is not what had been expected.

When the tidal marsh has silted up to above normal flood level, the area is mostly enclosed by dams. New polders in Groningen are: the Linthorst Homan Polder and the Emma Polder (Map 2). Within a short time the southern part of the Lauwers Sea, the Dollard (near the German frontier) and a complex near Ferwerd in Friesland will probably be fit for enclosure.

In view of the present price relations, coastal reclamations are no more directly remunerative than is the enclosure of the Zuiderzee, because the cost of newly reclaimed land may amount to twice or three times its selling-value.

Especially in countries with large reserves of land, as, for instance, Canada, it may, therefore, seem surprising that these works are undertaken.

The fact is that Holland, though small, is with its ten million inhabitants, one of the most densely populated regions in the world, so it is an imperative necessity for her social system to reclaim new land, also as annually a considerable amount is lost owing to the execution of public works (roads, canals, town extension). So each newly reclaimed hectare is of paramount importance to our increasing population.

Description of route. (Vide: route-map fig. 2.)

Coming from Groningen we first see a region with chiefly grassland on older, heavy sea-clay. Before reaching the village of Zuidhorn, situated on an emergence of pleistocene sand,

we pass seven old dikes, partially levelled now, the oldest of which probably date from the beginning of the 13th century or are perhaps older.

From Noordhorn to Niezijl the highroad lies on an old dike, built ca. 1400; from Niezijl to Kommerzijl on a dike dating from ca. 1425. West of the road we see the Ruigewaardpolder (diked ca. 1425); east of the road a strip of land along the old river Riet, diked in 1600. The region in which we are now, shows a quite different character. Here we find almost exclusively arable land on the less heavy and sometimes very light, young sea-clay.

As the route-map clearly indicates, the polders, which we pass from Noordhorn to the Lauwers Sea, have been laid out in the funnel-shaped widening which was formed in the mouths of the rivers Lauwers en Riet in the early middle ages. From Kommerzijl to Munnikenzijl the road constantly runs on old dikes, having on the south-side the Ruigewaard (diked ca. 1425) and on the north-side the Waardsterpolder (1666). From Munnikenzijl to the Lauwers Sea the road runs partly on the dike which separates Nieuw-Kruisland (diked from 1529 to 1542) from the Ruigezandsterpolder (1877). Then we proceed along the foot of the sea-dike, constructed in 1877, to Zoutkamp.

1. Land Reclamation Works.

Just before reaching Zoutkamp a visit is paid to the land reclamation works. During our walk across the newly reclaimed lands, which are dry at low tide, further particulars will be told and demonstrated about the technical part of land reclamation, vegetation, and soil-condition.

From Zoutkamp to Vierhuizen we pass through a district with older clay soils and large and splendid farmsteads.

At Vierhuizen we enter younger and very young polders. Here all the old dikes are still quite intact. The road passes through dips of the dikes, in which watertight partitions can be fitted in case of inundation of polders lying in front, in order to stem the flood.

From the dike, just outside Vierhuizen, we get a fine view of the Panserpolder (17th century), the Kerkvoogdijpolder (1927), the Westpolder (1875), the Torringa-polder (1837), and the older land.

2. Profile in a young sea-clay polder.

In order to get a good idea of these young polders we shall cross the whole Westpolder (diked 1875, area: 535 ha) with

its regular plots and large holdings (i.a. Mansholt's selection holding).

Table 1 gives a summary of the analyses of a soil profile of the Westpolder.

TABLE 1

Layer in cm	humus	CaCO ₃	0- 16 mu	16- 105 mu	> 105 mu	pH
0- 20	1.8	8	25	61	4.4	7.7
20- 27	1.6	9	25	50	4.6	7.5
27- 33	1.3	9	25	60	4.3	7.6
33- 53	1.1	11	27	58	4.2	7.6
53- 62	0.2	5,5	5	74	16	7.5
63- 74	0.4	7	6	77	11	7.6
74- 84	0.6	7	9	74	10	7.8
84- 89	1.8	9	31	54	3.9	7.6
89-140	0.7	6,5	13	69	11	7.7
140-150	1.0	7	10	52	30	7.5

When leaving the Hornhuisterpolder (1806), we again reach an older clay area.

The analyses of a sampled profile of this region are given in table 2.

TABLE 2

Layer in cm	humus	CaCO ₃	0- 16 mu	16- 105 mu	> 105 mu	pH
0- 13	1.7	—	17	75	6	7.4
13- 27	1.6	0.3	17	76	6	7.5
23- 47	1.0	—	20	74	4.2	7.1
50- 61	0.6	—	25	71	2.9	7.3
61- 76	0.4	1.9	22	72	4.2	7.6
76- 96	0.3	9	23	66	1.8	7.9
96-120	0.3	11	21	68	0.9	8.0
135-165	0.1	5	4.5	71	19	7.8
170-175	0.3	5	3.8	76	15	7.9
195-205	0.8	6.5	5.5	63	24	7.5

The difference with the profile of the Westpolder consists in the leaching out of the lime that went on to depths varying from about 60 to 70 centimetres. Presumably the young, calcareous clay soil loses 1 % of CaCO₃ in about 25 years.

From Ulrum (terp village) we proceed in a southerly direction and on the other side of Houwerzijl, we pass

through a number of young polders lying in the former wide mouth of the river Hunze.

3. *Pumping Station „De Waterwolf”.*

After crossing the bridge across the Reitdiep (the Hunze) a visit is paid to the Pumping Station „De Waterwolf”, which possesses four electrically driven screw-pumps, each having a capacity of 1,000 cubic metres per minute. The area drained by this station is about 100,000 hectares.

The circumstance that the young polders, close to the sea, have a higher ground level than the old clay area more inland, has always caused many impediments in the general drainage of the province of Groningen.

From „De Waterwolf” we reach Ezinge via Oldehove and we are now going to traverse the very old clay area with scores of large and small terps. We shall get a fine view of the partially levelled terp, on which the village of Ezinge is situated. Ever since 300 years before Chr. this terp has been gradually raised by the inhabitants in view of the steady rise of the sea-level. The terp is now lying 5 metres above the surroundings.

4. *Heavy textured clay profile.*

From Ezinge we are going in a southerly direction to Groningen. On our way we shall see another profile in the old clay of a sticky nature, the so-called „knik”. This is a heavy, chalkless, very stiff clay, of poor permeability and often red-veined by iron compounds.

Analyses of a sampled profile are given in table 3.

TABLE 3

Layer in cm	CaCO ₃	Humus	0-16 mu	≥ 16 mu	pH
0- 13	0	4.1	57.9	39.0	6.3
13- 23	0	2.5	60.6	36.9	6.5
23- 34	0	2.3	72.5	25.2	7.0
34- 41	0	1.5	81.1	17.4	7.3
43- 53	0.9	1.0	60.5	37.6	7.7
53- 66	3.8	0.8	53.7	41.7	7.8
66- 78	5.5	0.7	48.7	45.1	7.9
78- 94	7.8	0.9	50.1	41.2	7.9
94-110	8.2	1.4	53.5	36.9	7.7

The permeability of the layer 30-100 centimetres amounts to only 0.02 metre/24 hours.

Groningen

Part of the day has been reserved for getting acquainted with the research-work at the Agricultural Experiment Station and Institute for Soil Research T.N.O. and with the working methods of the Soil Testing Laboratory. The first mentioned Institute is engaged with the research of the soil and its fertility; the Soil Testing Laboratory analyses soil-samples on behalf of farmers. A more detailed description of their duties may be found in the booklet entitled: "Soil Science in the Netherlands, Indonesia and Suriname".

EXCURSION GRONINGEN II

THE RECLAIMED PEAT DISTRICT AND THE PROVINCE OF DRENTHÉ

Subjects:

- a. the Experimental Farm at Borgercompagnie,
- b. the excavation of the peat and the reclamation of the land,
- c. some re-allotment objects in Drenthé.

References:

- HUSEMANN, C. (1947) — Die landwirtschaftliche Bewertung der Moorböden und ihre natürliche Grundlagen — Lüneberg.
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- VISSCHER, J. (1931) — Das Hochmoor von Südost-Drenthé, geomorfologisch betrachtet — Utrecht.

Appendixes:

- Map 3, The pH-values of the soil at Borgercompagnie.
- Map 4, The humus content of the soil at Borgercompagnie.
- Map 17, Soil map Zweeloër Essen.

Route-map (fig. 3).

Excursion under the guidance of:

(*Peat District*)

(*Drenthé*)

G. M. CASTENMILLER

F. BONTEKOE

J. H. ENGELHARDT

L. H. BOUWMAN

J. J. SCHUURMAN

F. VAN SCHAGEN

J. J. WESTERHOF

Departure:

At 8.00 a.m.

Lunch at Hotel Grimme, Emmen.

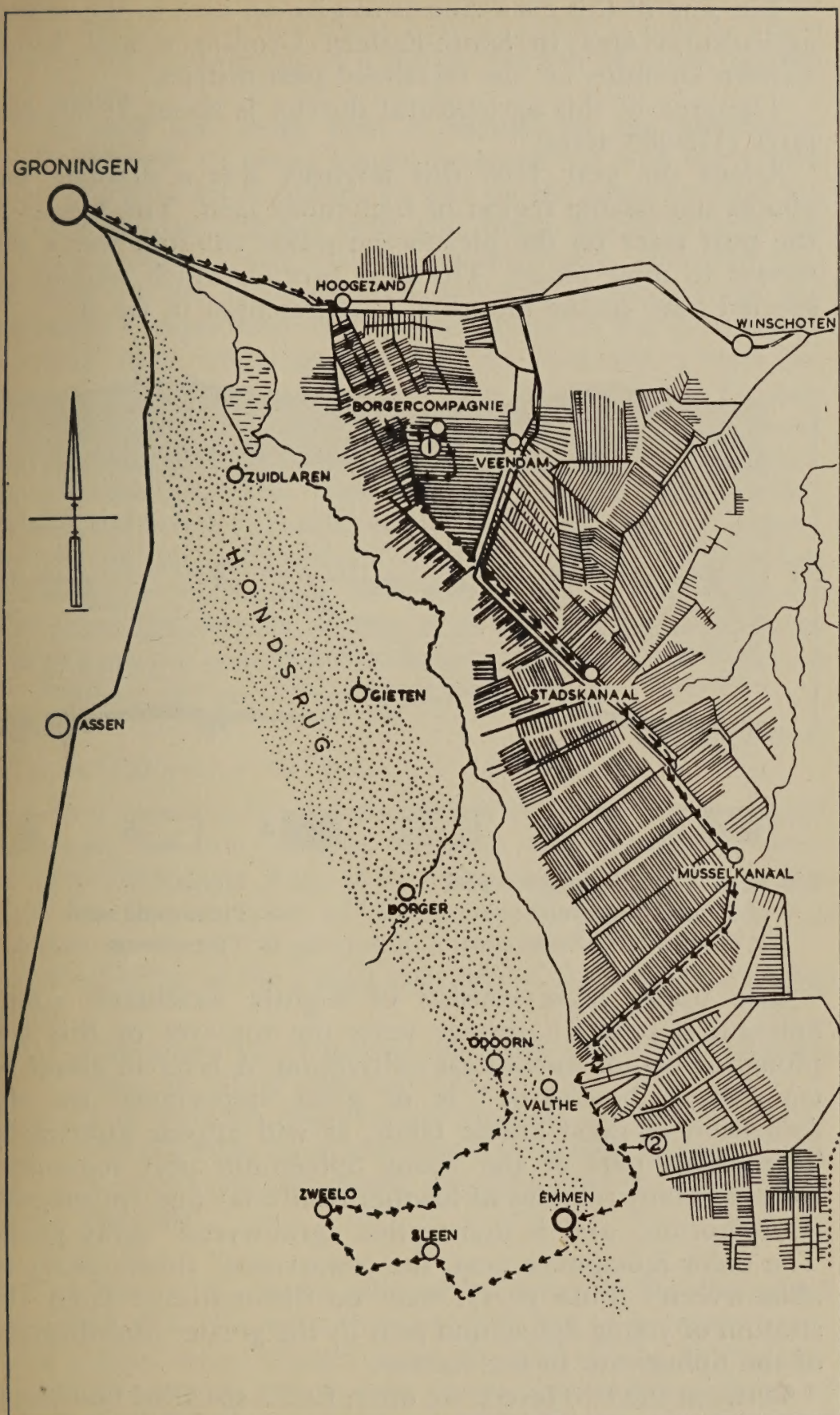


Fig. 3. Route-map

Introduction to the excursion in the peat-district

The aim of this excursion is to give an idea of the typical agricultural area in South-Eastern Groningen and South-Eastern Drenthe, i.e. the reclaimed peat district.

The area of this agricultural district is about 75.000 hectares (175.000 acres).

About the year 1500 this territory was a desolate and almost impassable region of high-moor peat. The height of the peat layer on the pleistocene sandy sub-soil, was a few metres in most places. The peat profile, which will be inspected later in the morning, is represented in fig. 4.

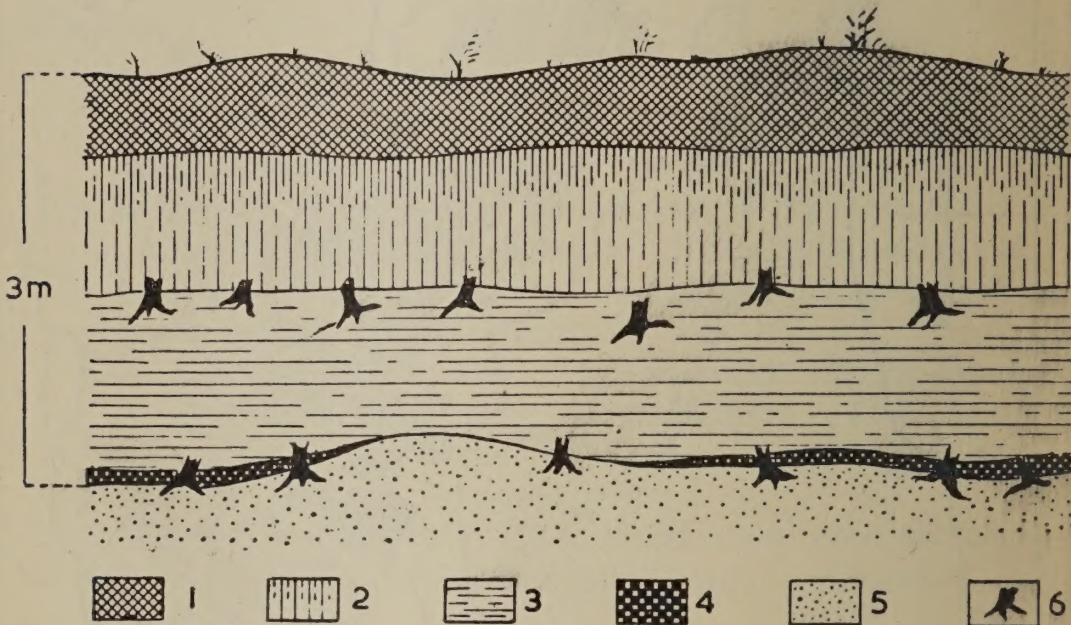


Fig. 4. 1. Young Sphagnum peat
2. Old Sphagnum peat
3. Reed and Sedge peat

4. Gytja
5. Pleistocene sand
6. Tree-stumps

The upper layer consists of slightly weathered young Sphagnum peat. In former years the toplayer of this was ploughed up for buckwheat cultivation. A layer of about 50 cm called „bonkaarde” is of great importance for the formation of good arable lands, as will appear afterwards. The lowest part of the young Sphagnum peat sometimes contains many remains of heather (*Calluna*) and cotton-grass (*Eriophorum*) and is then called „grauwveen” (gray peat). The older Sphagnum peat, the „zwartveen” (black peat) or „blauwveen” (blue peat), may be distinguished from the stratum of young Sphagnum peat by the greater humification of the Sphagnum in the former.

Between the two layers, we often find a so-called boundary-horizon i.e., a layer of peat chiefly consisting of remains of heather and cotton-grass.

Underneath the old Sphagnum peat we see reed (*Phragmites*) and sedge (*Carex*) peat, while on the line of demarcation between the two layers a stub-horizon is found. These stumps are the remains of a former growth of pines, birches and alders.

The reed and sedge peat is formed on the pleistocene sandy sub-soil. In many places, however, we first see a thin layer of gyttja on the sand. In and on the sand we find the remains of the original pine and birch forests. When the complete peat profile will be demonstrated, attention will be paid to the chemical and physical properties, to the botanical composition and to the dating of the peat-layers.

About 1600, when demand for fuel increased, a start was made with the cutting of the peat in South-Eastern Groningen on a large scale. It soon appeared that the sub-soil, which, after the digging of the peat became exposed, produced valuable arable land, especially, if the „bonkaarde”, (which was formerly considered worthless by the peat-diggers) was put on the sandy sub-soil. When about the middle of last century this „bonkaarde” turned out to be valuable for the peat-litter industry, it became necessary to issue regulations compelling the peat-maker to leave at least from 40 to 50 cm of „bonkaarde” on the land.

The excavating of the peat

A first requisite for the excavation of the peat area is good drainage. For this purpose the wide canals and the many branch-canals were dug; these waterways serve at the same time for the transport of the peat and later on ensure a regular transport of products.

The digging of the canals may take place in the following ways:

- (a) One main canal is dug, into which the branch-canals issue on either side (fig. 5A);
- (b) Two parallel main canals are dug 200 m apart; into one the right-hand side-canals are made to issue, while the left-hand side-canals are connected with the other (fig. 5B).

The one-canal system (the older system) has the great drawback that the main thoroughfare has to be constructed with a good many bridges across the side-canals. In the case of the twin-canal system, the main thoroughfare may be constructed in between the two canals. The one-canal system is found in the first part of the excursion for instance at

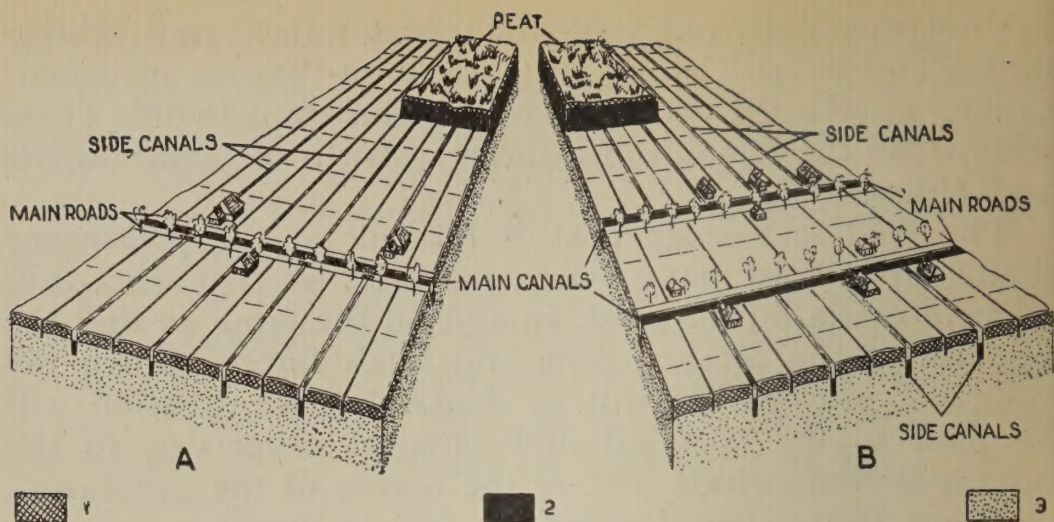


Fig. 5. The one-canal system and twin-canal system
 1 = „bonkaarde” 2 = peat 3 = sand

Borgercompagnie, the twin-canal system in the second part, e.g. at Valthermond.

Taking the canals as the starting-point, side-canals are dug at intervals of about 170 metres. The space between two branch-canals is divided into two rows of plots of about 1 hectare by means of one long parallel ditch and several cross-ditches. Each holding mostly possesses one strip between two branch-canals. The average area of a holding is 25 hectares (65 acres).

The peat area is first drained superficially by means of trenches for a number of years (fig. 6A). Proceeding from an existing side-canal and in the same direction a strip of the peat is cut away down to the sand and the squares of peat are piled up elsewhere to dry. The width of this „splitting” is about three times the width of the future side-canal (fig. 6B).

After that the side-canal is dug and the sand is deposited on either side of this canal, i.e. on the strips where the peat has already been dug off (fig. 6C).

Afterwards the peat is cut away annually in long strips of about 4×170 m. The toplayer of the peat, the „bonkaarde” is always conveyed to the bottom of the strip that has already been dug off (figures: 6D and 6 E). The other blocks of peat are removed, when dry.

The reclaiming of the peat area

When part of the peat area has been cut away in this way, the sandy sub-soil is, if need be, levelled and the „bonkaarde” is carefully spread on the sand. Then the sand

lying beside the side-canal is distributed and spread on the peatfield (figures: 6F and 6G).

The depth of the layer of sand thus deposited is about 8 cm. Then the sand is mixed with the upper thin layer of the peat by a good tillage, so that eventually a layer is obtained of about 16 cm (fig. 6H).

After an intensive application of fertilizers an arable soil has been obtained which, especially owing to its physical properties, may be reckoned among the best kinds of soil.

It is worth while noting, however, that many older reclamations of peaty districts show defects. For example, formerly part of the lowest firm peat was sometimes not cut away, in consequence of which the soil is not sufficiently pervious to water; in other cases the sandy sub-soil has not been levelled with the result that locally the „bonkaarde” is too thin or entirely absent. These older soils are now being improved by re-reclamation.

Up to about the year 1890 these reclaimed peaty soils were chiefly dressed with compost and farmyard-manure. During the first year after the soil had been prepared for cultivation, as much as 60,000 kgs of compost were added to it per hectare. The increasing reclamation of the peat districts resulted in a shortage of compost, in consequence of which farmers were obliged to keep more cattle in order to get sufficient farmyard-manure for the farm lands.

When towards the end of last century fertilizers came to be used, nearly all grassland was converted into arable land. The principal crops are now: farina-potatoes, rye, oats, wheat and sugarbeets. It is a remarkable fact that, also as a precautionary measure against increasing wind erosion, more green manuring crops and leys are used.

The agricultural problems that arise in these peat districts will be further explained and demonstrated at the Experimental Farm at Borgercompagnie.

In 1916 the Union for the Working of Experimental Farms in the Peat District was formed. This Union works two Experimental Farms, viz. one at Borgercompagnie on old reclaimed peat soil and one at Emmercompascuum on young reclaimed peat soil. The aim of these experimental farms is to afford an opportunity to Institutes for Agricultural Research to carry out experiments, while at the same time these experimental farms are of great value in showing the farmers what can be achieved.

The Experimental Farm at Borgercompagnie was laid out on reclaimed peat soil which has been cultivated for about 300 years. The total area is now about 30 hectares divided

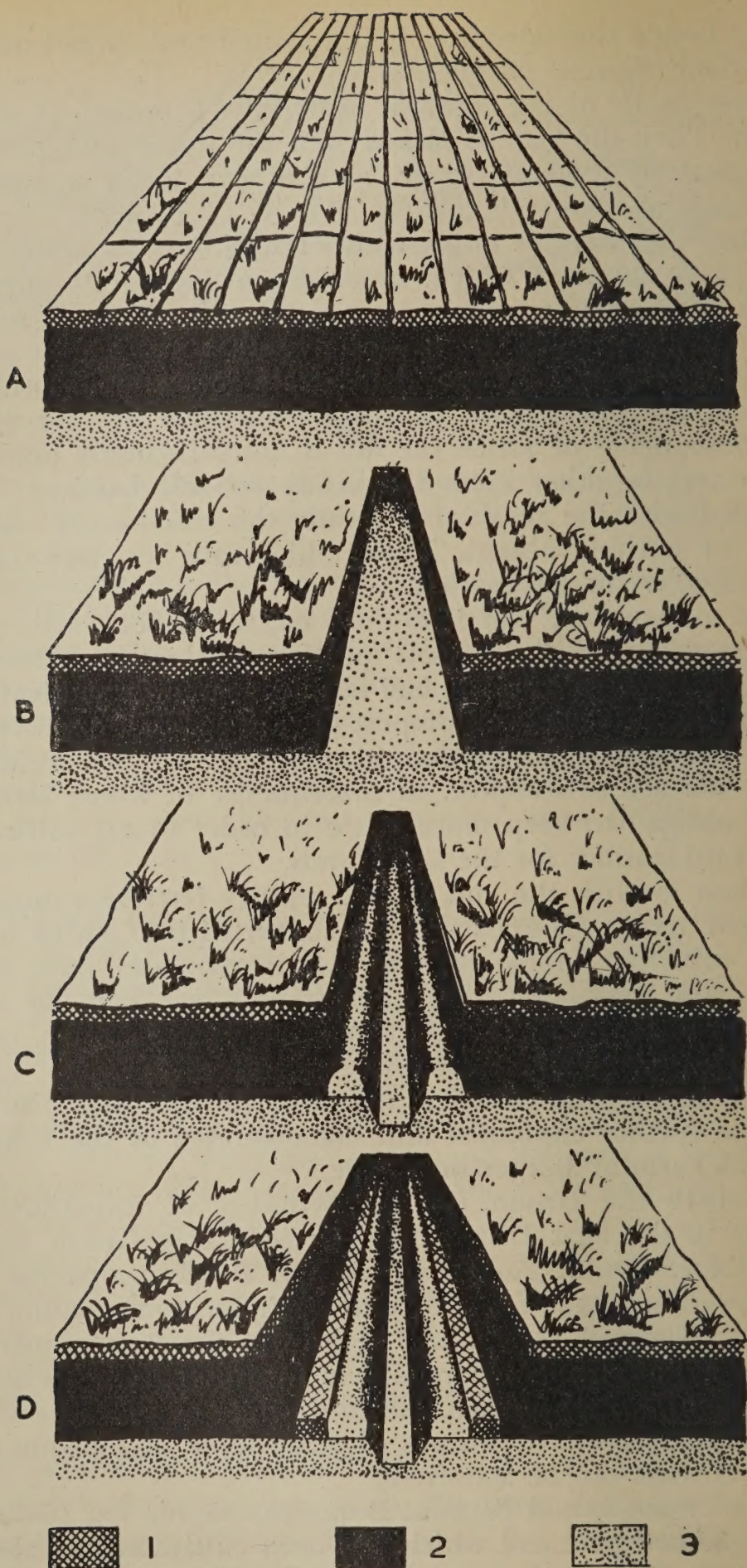
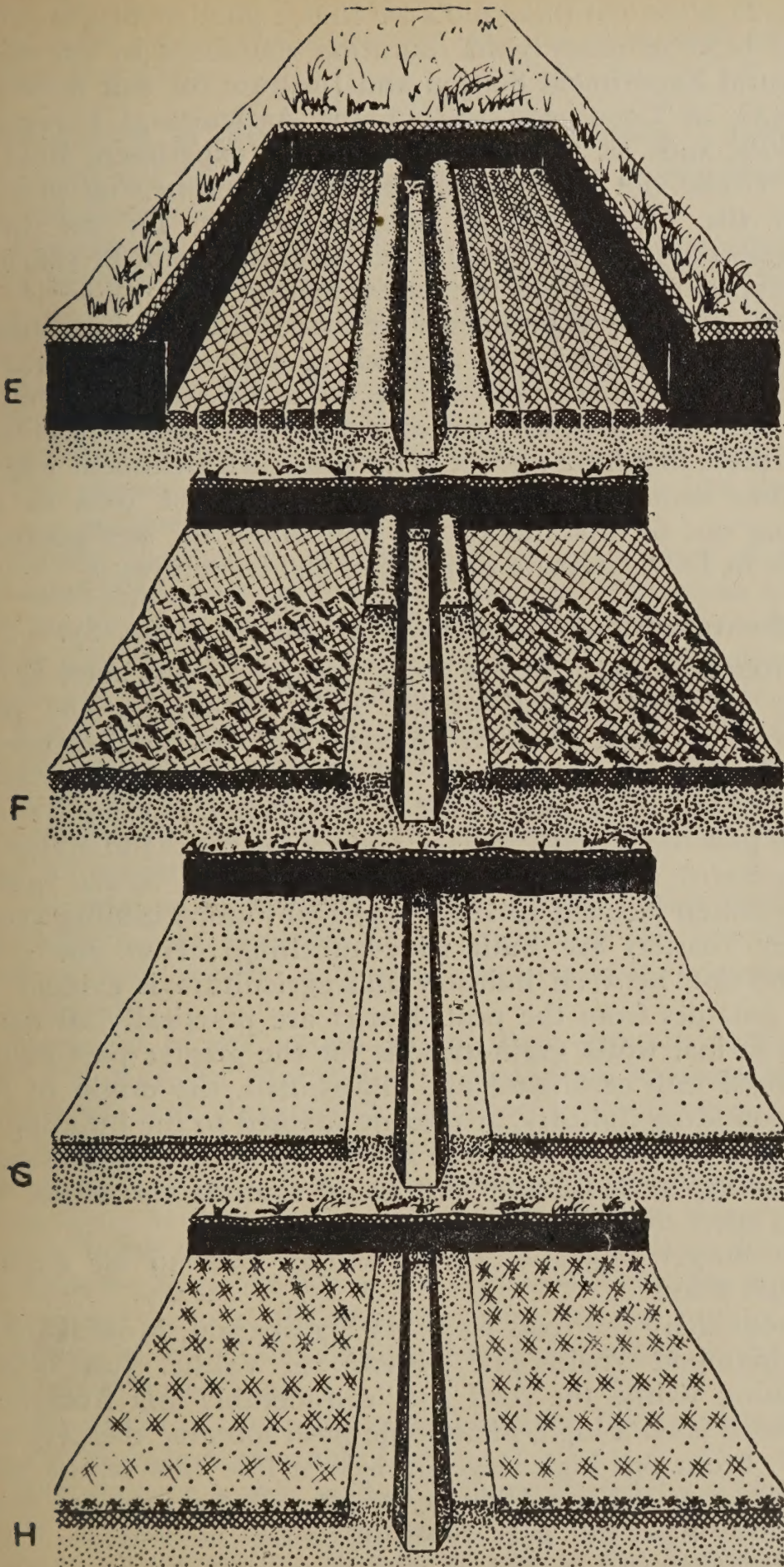


Fig. 6. The excavation of the peat and the reclamation of the land
 1 = „bonkaarde” 2 = peat 3 = sand



into 20 plots. On these plots we find a number of manuring trial plots of many years' duration sponsored by the Agricultural Experiment Station and Institute for Soil Research T.N.O. at Groningen and by the Agricultural Extension Service, such as, the general manuring experiment field Z. Gr. 1, laid out in 1918; the farmyard-manure trial plot Pr 800; the pH-magnesium sample plot Pr 19; the lime-magnesium-farmyard-manure demonstration plot Pr 120, and an experimental field for re-reclamation.

Besides, many experiments are made with different strains of crops and relating to methods of cultivation. Several of these experimental plots will be inspected, while by profiles the difference between peat soils that have been re-reclaimed and those that have not yet undergone such treatment will be further demonstrated. Attention will also be paid to the laying out of leys and to the store-house for seed-potatoes, built in 1929, having a capacity of 600 hectolitres.

Description of the route (Vide: route-map fig. 3).

From Groningen we are going along the Winschoter Canal (dug in the first half of the 17th century for the peat excavating) first through an area that has predominantly grassland on heavy sea-clay. Next the road runs across a strip of low moor peat as far as Hoogezand. On our way we shall pass the recently erected factory for the manufacture of fibre-board from grain-straw; the very large farina factory of Scholten (erected in 1842) and many ship-building yards, where coasters are built (side-launching). Here the close connection between industry and agriculture is evident, as the potatoes from the peat district are practically all made into farina, while grain-straw is for the greater part manufactured into cardboard and fibre-board, the origin of the ship-building industry, at present adapted to the building of coasters, has arisen from the former building of peat-barges.

Starting at Hogezaand and going towards the south, we shall enter the peat district by a new road.

At Borgercompagnie a visit will be paid to the Experimental Farm.

From there the road leads via Stadskanaal, Musselkanaal, Valthermond (twin-canal system) to Valthe. Just before reaching Valthe the road rises considerably and from here the road is on a high, pleistocene push moraine the „Hondsrug”. From this high ridge we have a fine view of the peat district that lies much lower. Nearly all the peat has been cut away now, but near Weerdinger Erfscheidenveen a few remains may still be seen of high moor peat that has not yet

been cut away. Finally a visit will be paid to a peat-digging area, after which this excursion will be concluded with a lunch at Emmen.

Introduction to the excursion in the afternoon — Drenthe

A visit will be paid to some re-allotment objects situated on the Drenth plateau.

The plateau, being bounded by a terrain-vaulting, running in a northwestern-southeastern direction, called the Hondsrug, forms part of the diluvial landscape of East-Holland (fig. 3).

It principally owes its aspect to the cover with land-ice from the Riss-glacial, at which the broad lines of the landscape-forms of the pre-glacial have, however, been preserved.

The present streamlets still indicate more or less the lie of the pre-glacial, original river-channels.

During the period of approaching ice a mass of fine-textured sand, many metres thick, was deposited, upon which the land-ice left the ground-moraine as boulder-clay behind. After and during the withdrawal of the ice, deposition of fluvio-glacial and aeolian cover-sands took place upon this.

The melt-water sought its way to the lower-lying parts and could exercise its erosive action here. Wide, flat valleys separate the remaining higher parts. Owing to bad drainage, peat-formation could make its appearance in the valleys. For cultivation they were of hardly any use.

The original inhabitants opened up their arable lands on the higher-lying grounds. Cattle grazed on the lower-lying parts, called „meads”, where a natural grassland-vegetation was found.

From out of the settlement the high grounds were put under cultivation. Even before podsolisation was possible in connection with climate and vegetation, grounds were in use.

The extension of the area of arable land took place concentrically, starting from the oldest cultivation soil. The dung from cattle in the old-fashioned cow-houses, mixed with sods of heath that were used as litter, was taken to the land as manure. By so doing, in the course of ages, the surface was raised by a dark-coloured layer, rich in humus, the thickness of which may be upwards of one metre in the case of the old arable lands.

The available quantity of sod-manure laid a restriction on the extension of arable land.

The younger arable lands are characterized by a humous layer of slighter thickness, while moreover a layer, disturbing for cultivation, may occur, due to the B₁-horizon of

RE-ALLOTMENT ODOORNER - ES

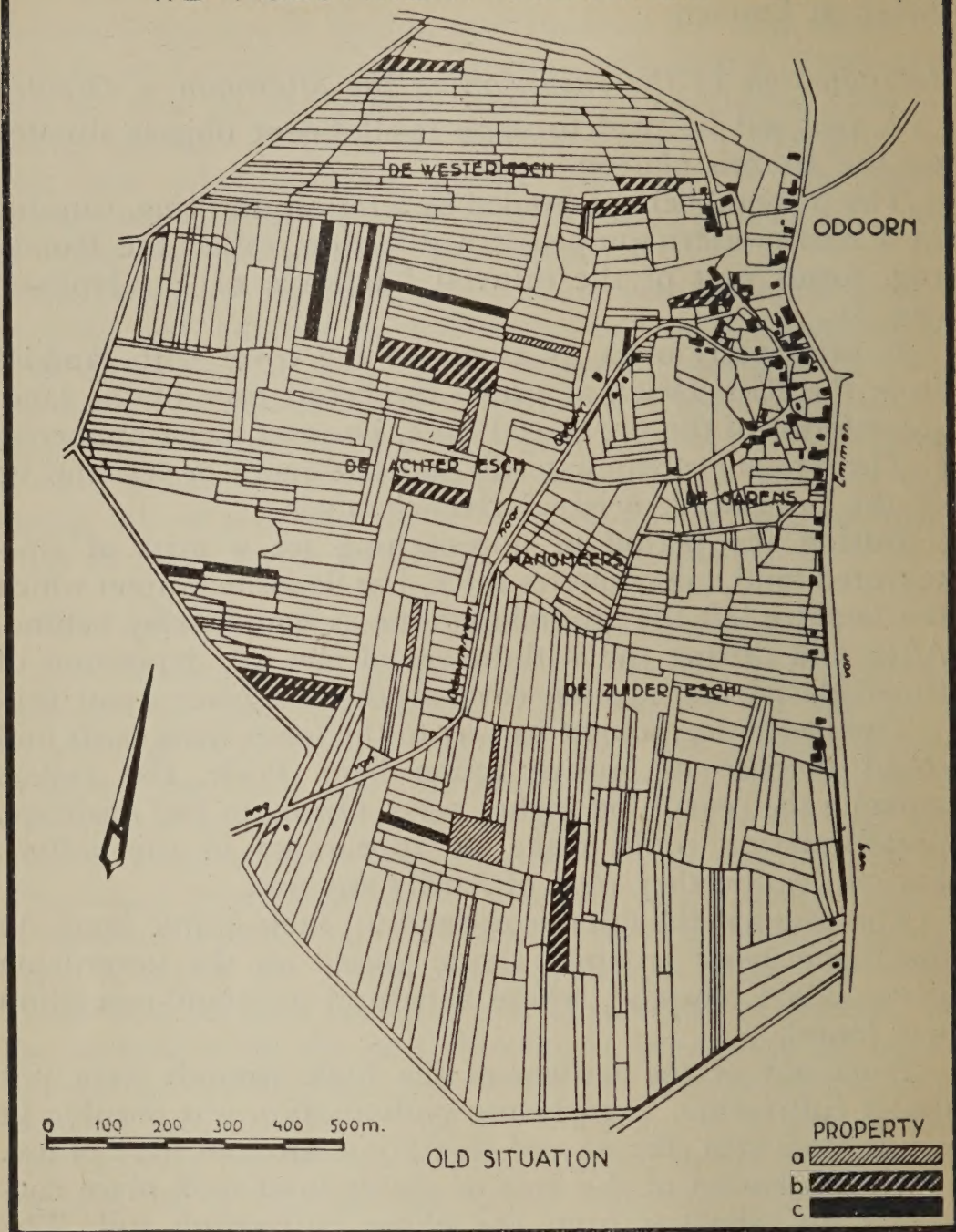


Fig. 7a

the podsol-profile, which may be baked together as a hard layer.

When towards the end of the 19th century, artificial manure became available, many heath-soils have been re-claimed since that time.

In the case of a good working-method, the profile is dug up, for example, to a depth of 60 cm, at which operation the A₂-horizon is worked downwards and the B-layer is mixed with A₀ and A₁.

RE-ALLOTMENT ODOORNER - ES

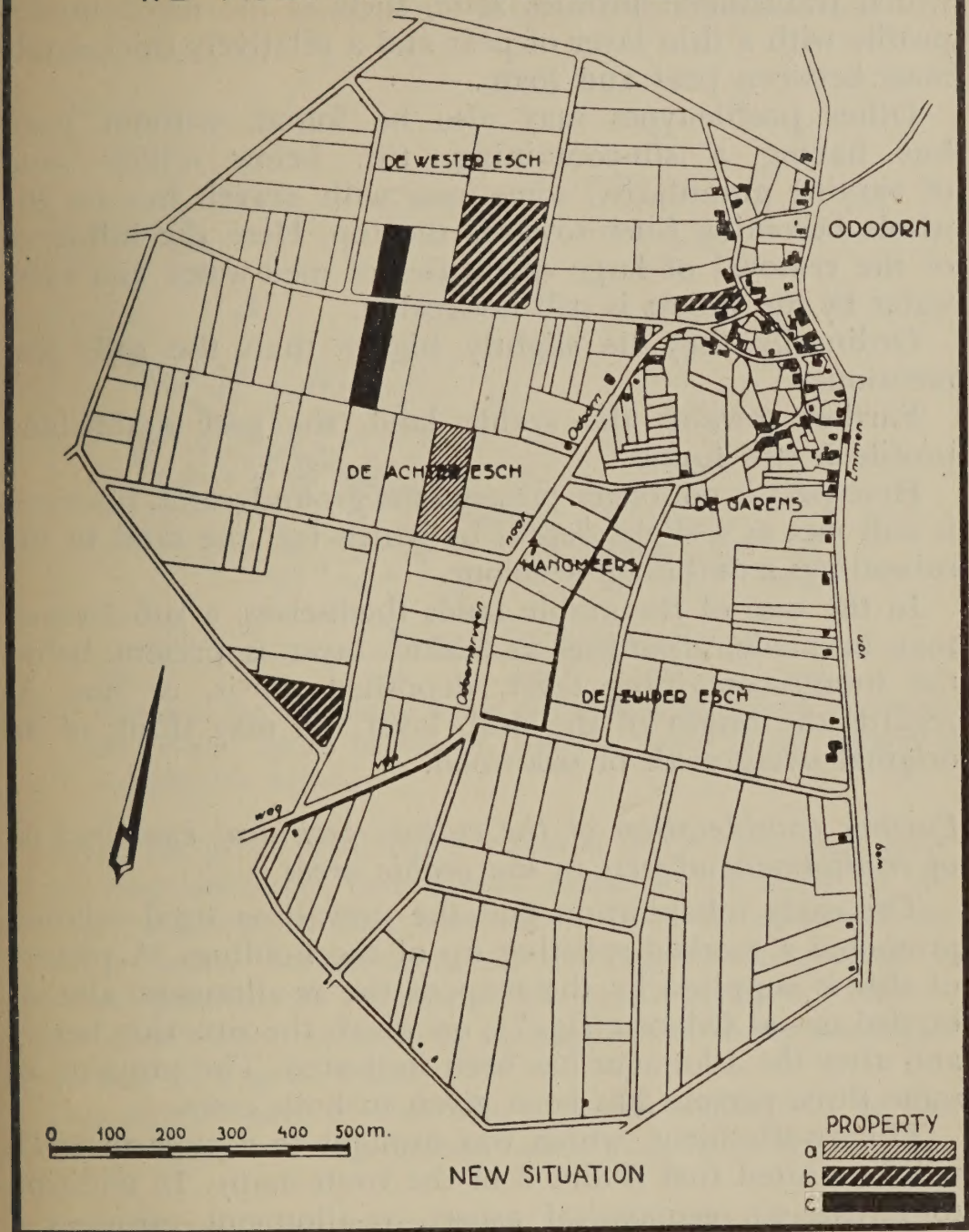


Fig. 7b

Less successful reclamations are also found the digging up and the working down of the layer of bleached sand did not take place so very carefully. In consequence of this there are also numerous variations in agricultural value.

The peaty soils in the valleys are only used as grassland owing to their low situation.

In the profile we come through a more or less thick layer of peat separated by a small, fine-textured sandy layer of little thickness from the boulder loam in the subsoil, which conse-

quently can come fairly close to the ploughed layer here.

The peat wedges out against the arable lands, through which transitional profiles arise, such as the marsh-border profile with a thin layer of peat and a relatively thick sandy mass between peat and loam.

Other profile-types may also be found, without peat, but having a silt-containing, till, below which sand of varying granularity, sometimes with gravel, but on the whole becoming finer towards the top. Here the influence of the removal of large quantities of melt-water and rain-water by the valleys is still noticeable.

Ordinarily they lie slightly higher than the soils just mentioned.

Further towards the arable land, the grey arable-land profile is still found.

Here peat is no longer present; the ground-water, however, is still met at a slight depth, by which fact the sand in the subsoil has a darkish-grey colour.

In the case of the arable lands themselves, a sub-division may be made, according as a drab layer is present below the humus-containing layer, deposited on it, or not. As regards the origin of the drab layer, we may think of an original overgrowth of oak-wood.

Further consideration of the culture-technical examination of re-allotment objects in the arable areas

The early inhabitation and the prevailing legal relation promoted a marked splitting up of the holdings. A picture of this is supplied by the map of the re-allotment already carried out at Odoorn (fig. 7), on which the situation before and after the allotment has been indicated. The property of some three persons has been given in both cases.

This re-allotment, which was brought to a close in 1943, will be visited first (Point 3 of the route-map). In addition to having an economical aspect, re-allotment possesses a planological and a pedological one.

As to the latter, in Holland re-allotment is, as a rule, attended with measures tending to improve the soil. In a parcelled out area, improvements may be carried out more remuneratively, in consequence of which private initiative is also encouraged.

As regards the state of manuring, it may be said that inquiry teaches us that remote parcels show, as a rule, a worse state of manuring, which is found expressed in a crop-depression, caused also by less care being bestowed upon the crops.

From figures 8 and 9G, it may be seen how in an arable-land area, the relation between P-citr. figure and distance and that between yield and distance, diminishes with increasing distance.

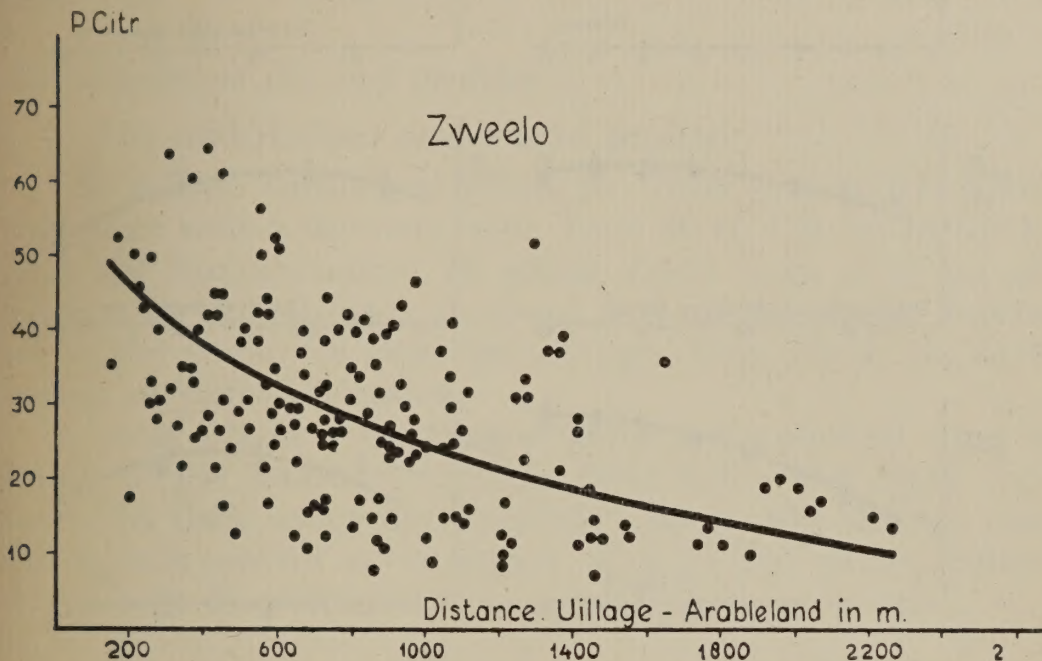


Fig. 8. Owing to the cumulative action of year-long and better manuring, the P-citr. figure of parcels, situated closer to the village, is considerably higher.

Seeing the great difficulties involved in giving a new place to holding buildings, care should especially be taken in the case of re-allotment that easy accessibility be obtained, by which a better maintenance of the cultivation ground is rendered possible. In the case of the re-allotment at Odoorn, it has been aimed at making each parcel directly accessible bij means of a good road.

The second part of this afternoon-excursion will be devoted to a visit to the arable lands at Zweelo (route-map, point 4).

Here a re-allotment is being carried out. Preparatory, culture-technical examination of the soil was carried out, in order to get acquainted with the factors that might be of importance from a pedological standpoint, in connection with possibilities of improvement.

The factors which, in the case of these soils, having a groundwater level some metres deep, govern the moisture-retaining capacity of the profile are in addition to the humus-content, already stated, and the thickness of the humous, black top-layer; the thickness of the humus-containing subsoil, the depth of the layer of loam and the coarseness of the sand (figures 9A to E, inclusive).

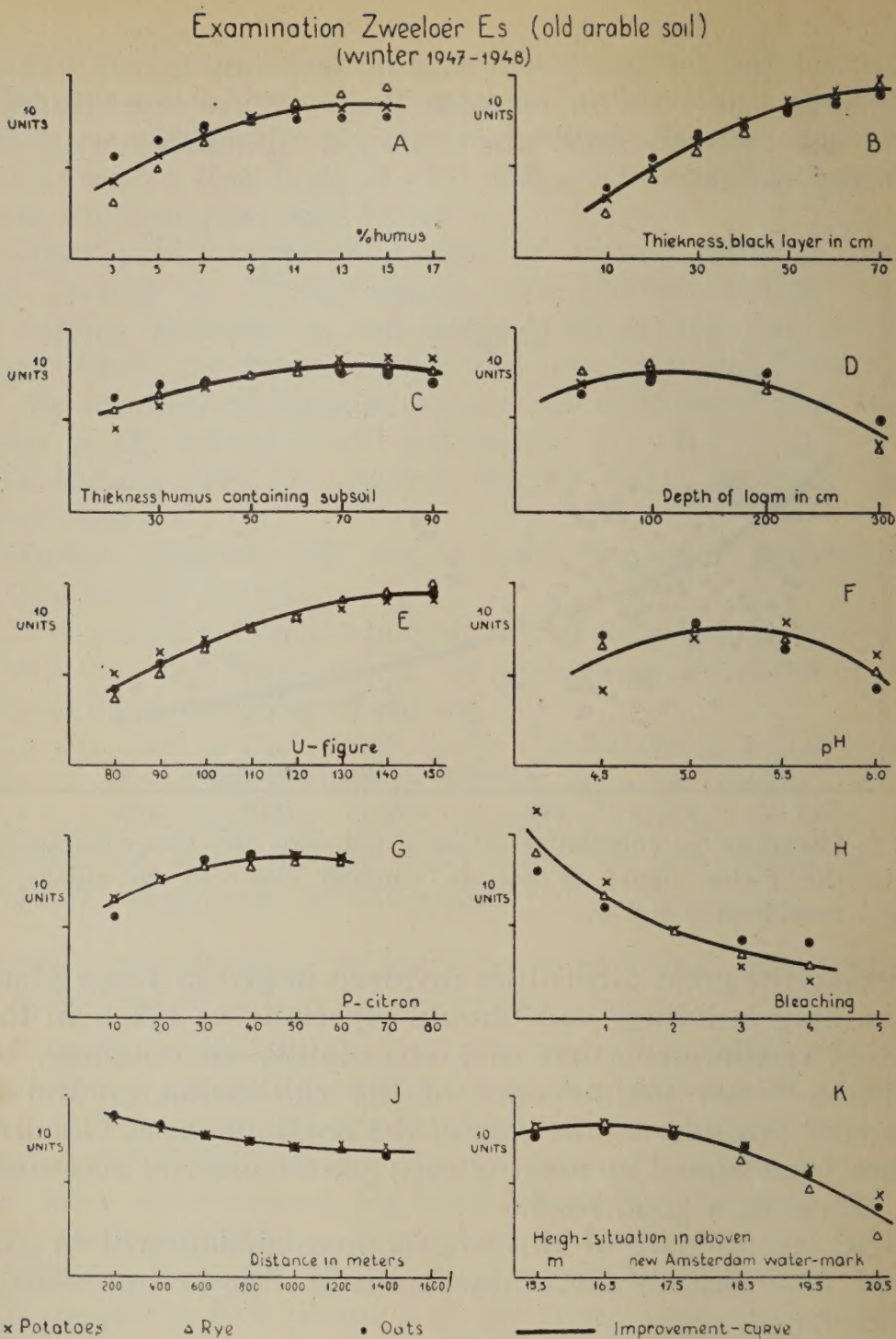


Fig. 9. Curves used in connection with the improvement of the crop-land on the Zweeloër Es.

A consideration of some ten properties accounted in a satisfactorily accurate way for the mutual differences in the reaction of the crops on circumstances of environment.

The U-figure (specific surface) is a measure by means of which the coarseness of the sand-fraction may be characterized (fig. 9E).

By bleaching is meant the extent to which the top-soil, which is rich in humus, is mixed with bleached grains of quartz (fig. 9H).

Distance is a maintenance factor and bears upon the distance of the parcel to the holding buildings (fig. 9J).

The height-situation is in itself no growth factor. The remaining influence of factors that have not been considered, is, however, represented in the curve for the height-situation (fig. 9K).

During the excursion it will be possible to get an idea of the agricultural value of some profiles found in this area. Some arable-land profiles and some low-lying grassland profiles will be shown, along with the transition between these two.

Description of the soil profiles.

a. The undisturbed arable-land profile.

The subsoil consists of yellowish white cover-sand; upon this there rests a humous layer, from 40 to 120 cm in thickness, the humus-content of which varies from 9 % on an average in the top-layer to about 4 % in the deeper layers, while the colour in this case changes from black via dark brown to yellowish-brown.

In some places a characteristically drab-coloured zone is found in the humus-containing layer below the black top-layer. In these cases the humous layer is also thicker and the humus-content of it higher than in the places, where this brown discoloration does not occur.

b. The river-channel profile.

Below a silt-containing, thin top-layer, rich in humus, we come across a sandy mass, about 60 cm thickness, beneath which loam is found. The sandy mass is strikingly strongly stratified; small layers of coarse and fine-textured sand alternate; on an average, however, the granular coarseness increases with the depth.

c. The marsh-border profile.

This profile is about the same as the preceding one, the difference being, however, that the top-layer now consists of peat to a maximum thickness of about 10 cm, while the sandy layer is of a more homogeneous composition.

d. The blown-sandy podzol profile.

Below a layer of blown-sand of varying thickness we meet with a completely developed A-B-C-profile.

EXCURSION GRONINGEN III NORTH-EASTERN POLDER

Subjects:

- a. Land-reclamation in the Zuyderzee region.
- b. Process of maturation in the soil.
- c. Soils of the Kampereiland (in the afternoon).

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Appendixes:

Map 5, Schematic soil map of the North Eastern Polder.

Map 18, Soil map of a part of Kampereiland.

Route: See Map 5.

Excursion under the guidance of:

(North Eastern Polder)

(Kampen)

L. E. M. KLAAR

J. VAN DER MOLEN

W. H. VAN DER MOLEN

J. NAUTA

H. SMITS

J. POST

B. VERHOEVEN

B. VERHOEVEN

C. WIT

W. C. VISSER

A. J. ZUUR

Departure:

At 8.30 p.m. by bus.

Lunch at Restaurant „De Beurs” Emmeloord.

Return at Zwolle at 4.15 a.m.

Departure by train to Arnhem at 4.49 p.m.

Departure by train to Amsterdam, the Hague, Rotterdam at 4.51 p.m.

THE NORTH EASTERN POLDER

Introduction

During the 8th and 9th centuries a form of land reclamation was put into practice in Holland, at which upgrowths in front of the coast and accretions along the coast were protected against the water by the construction of dams.

In later ages this was done by the building of dikes in which case a waiting attitude was adopted until the accretion had grown in size from about 25 to 30 cm above the daily or average flood-stage.

In this way large areas of Zeeland, North-West Brabant, the South-Holland Islands, the North of North-Holland, and parts of Friesland and Groningen originated by the successive embankment of accreted soils.

The drainage of the areas reclaimed in this manner mostly took place at low tide.

In the beginning of the 15th century wind water-mills were first utilized in this country. This opened new perspectives as regards the reclamation of land. Thus shallow pools or small lakes were surrounded by a dam and afterwards drained by means of a wind water-mill, as early as about the middle of the 16th century.

The grounds thus reclaimed, which lay a few metres below the groundwater level of the surrounding country, were then intersected by ditches and trenches and provided with drainage-plants in order to keep them dry.

The possibilities for this form of land-reclamation increased still further, when pumps came to be used for draining. These pumps were driven by steam-engines at first and afterwards by electromotors and Diesel-engines.

The Zuyder Zee operations belong to this latter type of land-reclamation industries. They deviate, however, from it in that a lake has first to be called into being by building dikes in the open sea, which lake can then be pumped dry.

The recent isolation and partial drainage of the Zuider Zee is the largest work that was ever undertaken in this domain.

Besides in extent, it also deviates entirely in organization from the areas formerly pumped dry.

Formerly everything was left to private initiative, but now the State has taken the whole task in hand.

Both the aspect of the food-supply during the time of war of 1914-1918 and the floods of 1916 led to an Act being called into existence in 1918, in which the foundation was laid for this grand work, the execution of which is attended to by authority of the government (drainage, putting under cultivation, and colonisation).

The plans embodied by this Act comprise in brief:

- I. The making of an enclosing dike from North-Holland to Friesland.
- II. The drainage of four polders in Lake IJssel, thus formed by its isolation, namely:

the Wieringermeer	abt.	20.000 ha
the North-Eastern Polder	„	48.000 ha
the South-Eastern Polder	„	96.000 ha
the South-Western Polder	„	56.000 ha
total		220.000 ha

or equivalent to 7 % of the total area of the Netherlands or 10 % of her acreage under cultivation.

After reclamation by drainage in accordance with these plans, there will remain a lake (IJsselmeer) of about 100.000 hectares, which is absolutely necessary for delivering fresh water to the adjoining provinces.

A provisional survey of the bottom of the sea proved that the latter consisted partly of fertile clay and sandy clay, partly of less fertile sand, and that the 100.000 hectares of Lake IJssel could consequently be best isolated on that spot where the soil is sandy.

The subjoined little map is intended as a general view of the projects already carried out and those which still have to be executed.



Fig. 10 Survey of the Polders of the IJsselmeer.

Plan for the partial drainage of the IJsselmeer.

Wieringermeer 20.000 ha; North-Eastern Polder 48.000 ha;

South-Eastern Polder 96.000 ha; South-Western Polder 56.000 ha.

Total: 220.000 hectares.

The operations that go with the reclamation are carried out in close, mutual co-operation by the various branches of the service. Thus there is a hydraulic department, a culture-technical department, an agricultural department, a social-economical department, and a research department (pedological, micro-biological, botanical, agronomical) and also a department of extension.

The pedological work of the research department is of fundamental importance and always precedes the plans for the drainage. Soil samples are taken under water at different depths and are afterwards analysed in the laboratory. With the aid of the data thus obtained a provisional soil-map is drawn up, on the basis of which it is possible to decide how the future dike has to be built. The area having become dry, the above operations are continued in a more detailed way, at which the soil is, as a rule, mapped out to a depth of 1.50 m. This is done, *inter alia*, for the benefit of the agricultural extension, for culture-technical advices, and for the determination of the rent. The deeper sub-soil is, however, also subjected to an investigation in connection with the establishment of centres of population and the building of farm-steads. The department also advises about drainage and supervises drying up and the structural formation of the soil in connection with the yields.

The removal of the salt from the soil and problems in the sphere of chemistry are also subjected to investigation. As to the percentage of salt of the soils in the North-Eastern Polder, it may be observed that until 1932 this inlet stood in open communication with the North Sea. The percentage of salt of the water amounted to about 10 grammes NaCl per litre.

After 1932 an inland lake, IJsselmeer, came into being in consequence of the stopping up of the Enclosing Dike; this lake quickly received a fairly large quantity of fresh water from the rivers that discharged themselves into it.

By diffusion the salt of the upper layers quickly leached out then.

As a result of the soil-survey, it appears that the ploughed layer (the tilth) of the North-Eastern Polder consists of:

moderately fine and medium-fine sand	3000 ha
very fine and extremely fine sand	4000 ha
sandy loam	13000 ha
loam, silt loam and 500 ha of clay loam	35000 ha
peat and peaty soil	1500 ha
diluvial sand and boulder clay	1000 ha

Total 47500 ha

The soil of the North-Eastern Polder. (A pedological map may be found as appendix, map 5)

The lowermost part of the North-Eastern Polder is built up of diluvial deposits. In their upper layer these sometimes consist of boulder clay, but mostly, to a considerable depth, of the sandy Würm-glacial deposits.

In the south-western part of the polder these Würm-glacial deposits lie about 5 metres below the present surface of the surrounding country. Towards the north-east it rises gradually: in the wider surroundings of Kuinre it constitutes part of the sub-soil and closer to Kuinre, extending over a fairly large area, it even forms the top-soil. It consists of medium-fine, non-calcareous sand with a distinct vegetation-profile (ABC or AC) dating from a time that it formed the surface and was still lying above the water.

After the deposition of the Würm-glacial deposits, the water-level rose in these parts, and the bottom was covered with a thick layer of peat, in which a layer of clay was inserted in the western part of the polder. The peat certainly reached a depth of 1 m below the present sea-level.

In consequence of the inroad of the sea in this area in the middle ages, the peat-landscape was destroyed for the greater part. In the deeper sub-soil peat is found rather frequently; in the sub-soil and upper layer we come across it only in the neighbourhood of Lemmer, Schokland, and Urk.

Part of the smashed peat, mixed with mineral components, has again been deposited on the rests of the autochthonal peat as a kind of peat detritus. This occurs in the deeper sub-soil, in the greater part of the polder; in the sub-soil, important from an agricultural point of view, its occurrence is confined to the north-west of the polder and in the top-soil to a small area to the south of Lemmer.

The next layer is a mineral deposit, brought here by a fresh-water precursor of the Zuider Zee. This occurs in the sub-soil of the greater part of the polder, except, of course, where the older deposits reach the surface of the surrounding country.

Except on more protected spots during its formation, such as close to the coast (but beyond the reach of the breakers) and around Schokland, where the clay-content is higher, it consists of a calcareous, light sandy loam, made up of fine-textured sand.

In the centre and the west of the polder this deposit often forms the direct sub-soil; in the east the younger layers are

thicker, so that there it determines the soil-profile to a less extent or not at all.

The top-layer of the polder is composed of a marine, calcareous deposit, which in the west consists of extremely fine sand, becoming thicker and heavier towards the centre and the east (loam and silt loam).

Still closer to the coast the marine deposit becomes even thicker and lighter, too; the decrease of the clay-content starts in the top-layer first.

Near the coast the marine deposit exceeds a depth of $1\frac{1}{2}$ m and consists of extremely fine clayey sand. The sand contains from about 2 to 5 % of particles smaller than 0.002 mm; the sandy loam from 5 to 12 %; the silt loam from 12 to 25 %.

Medium-grained and moderately fine-grained sandy soils of local origin are still found in several places along the coast, for instance, to the south of Kuinre. They come from Würm-glacial sand that has been washed away or brought up by the river Kuinder. Near Urk and Vollenhove they have a fluvio-glacial origin. Finally a large complex to the east of Schokland was brought up by the river IJssel.

In contradistinction to the two first-named complexes of sand, the last-named complex possesses a fairly high clay-content.

Leaving out of consideration the less important kinds of soils: boulder clay, Würm-glacial deposits, peat and sands of local origin, the North-Eastern Polder consists in the centre of a layer of loam and silt loam to a depth of the tilth, below which we find the very dense loam, made up of fine-textured sand (soil-type : heavy on light).

To the west the top-layer of silt loam passes into sandy loam, so that the soil there consists entirely of sandy loam or sometimes of clayey, extremely fine sand (soil-type: light on light).

From the centre to the east and also around Schokland the heavy marine top-layer becomes thicker, while there the transitional layers to the elsewhere sandy loamy fresh-water deposits, also belong to the silt loam. Then the soil consists of silt loam to a depth of at least 80 cm (soil-type: heavy on heavy).

Nearer the coast the upper part of the heavy marine top-layer passes into sandy loam (soil-type: light on heavy).

Still nearer the coast the sub-soil becomes lighter, so that there we find again the soil-type: light on light. Quite close to the coast this then passes into sand.

In the north of the polder, peat (and peat detritus) and Würm-glacial deposits play a part in the soil-profile that becomes more prominent towards the north, so that there,

too, we come across the soil-types: sandy loam on Würm-glacial deposits and sandy loam on peat.

The excursion

The points that will be demonstrated during the excursion are:

1. *Infiltration* (sub-soil irrigation) (Ramspolzand with a visit to plot P 44).

In the North-Eastern Polder there are a few sandy areas which, dependent upon the nature of the sand, suffer more or less from damage caused to the crops by drought during the summer season. When used as arable land, these soils are readily blown away in the form of dust, for which reason they are being used as grassland for the greater part.

In order to prevent damage by drought and for the supply of drinking-water for the cattle, fresh-water from the IJsselmeer is admitted to these sandy areas, inter alia, by means of inlet-sluices in the embankment.

In these areas drainage serves both for the carrying-off of superfluous water during winter and for the supply of water from the flushed main-ditches in the fields during summer.

In view of this sub-soil irrigation, the drains are then laid without any slope towards the main-ditches, consequently horizontally. The interval and depth of the drains are made conditional on the permeability (coarseness) of the sandy soil.

For the coarsest sand these measurements are about 30 m and 70 cm respectively; for the finest sand 8 m and 100 cm.

The depth of the drains and the corresponding flush-level of the groundwater are related to the capillary height of ascent of the water; this height of ascent is about 35 cm in the coarsest sand and upwards of 100 cm in the finest. The groundwater level aimed at is about 35 and 90 cm respectively below the surface of the soil.

From the inlet-sluices the water is conveyed to the polder by means of the main ditches of supply. The main source of supply gives off to each ditch that is passed, the desired quantity of water. In the ditches the desired level is obtained by the aid of concrete flush-pits. The water-level in the soil is obtained in several other ways, dependent upon the demands made by the different soils. In the areas with coarse sand, deficient in clay, intended for permanent grassland, the drains run righthaw into the main-ditches, in which the level is maintained at from 35 to 50 cm below the surface of the soil (Urkzand and Kuinrezand).

For the Rampspolzand, which is coarse textured, but also

slightly clayey and which is set aside for mixed holdings and partly for horticulture, another system of infiltration is applied: the plots are divided into parcels of about 3 hectares (300×100 m), the drains of which have a collective outlet (capable of being closed and adjusted) at one end into a main-ditch, filled with water, and at the other end into an empty one.

By this it is possible to establish the artificial groundwater level for each parcel, as circumstances require, at a height of between 40 and 70 cm below the surface of the soil. On the horticultural plots the division is carried through further still. Here the parcels with a water-table of their own have an area of about $\frac{3}{4}$ ha.

The transitional soils between sand and sandy loam and also the lightest sandy loam soils themselves, which are unsuited to infiltration, only get drinking-water in the ditches for the cattle.

Heavier soils with coarse sand underneath the ploughed layer, along with plots having a peaty sub-soil, require infiltration, though the latter should be adapted to these special circumstances.

The maximum quantity of water to be supplied for coarse-sandy plots, infiltrated wholly by means of drains, has been fixed at 0.9 litres per second per hectare, which is equivalent to a rainfall of 8 mm per 24 hours, at which the possibility of losses resulting from subsoil flowing-off has been taken full account of. From 0.5 to 0.6 litres per second and per hectare at the utmost will, however, almost always suffice.

For keeping the ditches filled only with drinking-water for the cattle, $\frac{1}{10}$ litre per second and per hectare should be taken. For the exclusive provision of drinking-water, the water should be flushed to a level not exceeding 60 cm below the surface of the soil.

PROFILE I. (plot P 44). A calcareous, loamy sand

0—> 60 cm clayey, moderately fine sand (marine)

4 % fraction < 2 μ — 0.6 to 1 % organic matter — about 8% CaCO_3 .

In view of the fact that the soil is so young no horizons are found in the profile; only the difference between aerated and reduced soil being visible.

2. *Process of Maturation of a silt loam soil (plot T 51).*

The parent-material from which the arable soil of the North-Eastern Polder developed, consisted of a water-

saturated, anaerobic, agro-microbiologically, almost sterile sediment, useless from an agricultural point of view.

The impetus which rendered the ripening of the soil possible and which led to the formation of a sub-stratum, suitable for plant-production, came from man, who, by reclamation, upset the existing states of equilibrium, and who, moreover, guided the unshackled reactions in the direction desired by him.

In consequence of the drainage thus taking place, physical changes make their appearance in the very first place, changes which result in certain chemical and biological processes being started.

Consequently one might speak in this connection of a physical, a chemical, and a micro-biological process of soil-ripening.

The physical maturation of the soil is caused by the drying up of the sediment — withdrawal of water by trickling out and especially by evaporation — which process is attended with a penetration of air.

The rapidity with which this process proceeds depends upon the texture and the content of humus of the material.

The sediments which are richer in colloids will shrink in horizontal and vertical directions during this process of drying up, cracks (fissures) being produced, while structure-formation appears. The result of it all is that the soil gets aerated in an increasing measure, while the water-storing capacity and permeability become greater.

The lighter soils containing little colloidal material do not shrink and do not crack either.

The physical ripening of the soil may be best characterized by the changes in the moisture content of the sediment after becoming dry. These facts are of great significance in connection with advices as to detailed drainage. For the primary pores are too fine for a water-movement of any importance. The water-movement practically takes place only through the fissures. The richer in clay the soil is, the more fissures are formed; the more permeable the material, the greater the intervals may be for making trenches and for draining.

The chemical maturation of the soil develops under the influence of the air, which penetrates into the soil at the shrivelling-up process.

The anaerobic parent-material is rich in FeS_2 and FeS , in consequence of which it is of a black colour. It contains from 0.3 to 0.7 % of S per 100 grammes of oven-dry material. Besides it mostly contains about 10 % of CaCO_3 , while soil-

colloids hold a certain amount of Na in an exchangeable state, in addition to Mg, Ca and K, as a result of the former penetration with sea-water.

By the penetrating air iron sulphides are oxydised, H_2SO_4 being inter alia formed, which is neutralised at once by CaCO_3 , while CaSO_4 is produced. This compound, which is better soluble than CaCO_3 , produces Ca-ions, which exchange the Na-ions adsorbed to the soil-colloids. By that the colloids get flocculent, while the structure-formation benefits by it. The chemical ripening of the soil may consequently be further traced by the decrease of the amount of adsorbed Na and by the total content of S of the soil.

As to the micro-biological process of soil-maturation it may be observed that after about six years the micro-flora has reached the standard of ripe soils on old lands.

PROFILE II. (plot T 51). A half-maturated calcareous silt loam underlaid by moderately fine, non-calcareous sand.

- 0-20 cm silt loam (marine)
19 % fraction < 2 μ - 2 % organic matter - 10 % CaCO_3
- 20-30 cm clay loam (marine)
26 % fraction < 2 μ - 4 % organic matter - 10 % CaCO_3
- 30 cm very fine sand (marine) with shells
4 % fraction < 2 μ - 0 % organic matter
- 30-70 cm loam (marine)
23 % fraction < 2 μ - 3 % organic matter - 10 % CaCO_3
- 70-80 cm sandy loam (brackish)
12 % fraction < 2 μ - 3 % organic matter - 8 % CaCO_3
- >80 cm moderately fine sand, poor in clay
1.5 % fraction < 2 μ - 0 % organic matter - 0 % CaCO_3

Originally the whole profile had the same blackish-blue colour and the same strongly smearing consistency as may be observed at this moment at the layers which occur at depths varying from 70 to 80 cm. This material is still absolutely unaerated. Higher up — the ripening starts as a matter of fact at the upper end of the profile — the process of maturation may be clearly traced.

At the outset aeration, which is clearly visible on account of the change in colour of the soil, only took place by means of root-channels, the number of which increases upwards. Fissures are absent. Above 40 cm the profile is entirely aerated and distinctly cracked. The soil is also more consistent here. Higher up the number of cracks, in consequence of which structure-aggregates are formed, becomes larger. The friability, too, of the soil increases. One can see how the aggregates develop via columns and sharp-edged structure-

elements into the structure of the soil as is found in the ploughed layer.

3. *Constitution of the soil in the North-Eastern Polder* (vide: the introduction)

PROFILE III (plot N 3). A half matured, calcareous silt loam, underlaid by a sandy loam on peat detritus.

0-25 cm silt loam (marine)

19 % fraction $< 2 \mu$ - 2 % organic matter - 10 % CaCO_3

25-35 cm clay loam (marine)

28 % fraction $< 2 \mu$ - 4 % organic matter - 10 % CaCO_3

35-37 cm very fine sand (marine) with shells

4 % fraction $< 2 \mu$ - 0 % organic matter

37-45 cm very fine-sandy, sandy loam (brackish)

8 % fraction $< 2 \mu$ - 2 % organic matter

45-65 cm weak humous to humous sandy loam (brackish)

8 % fraction $< 2 \mu$ - 4 % organic matter - 5-9 % CaCO_3

65-150 cm peat detritus and peat

> 150 cm Würm-glacial sand with AC vegetation-profile

The ploughed layer, which originally consisted of a plastic mass, coloured blackish-blue by FeS, has already dried up considerably. The soil that may be crumbled more readily than similar, older soils, has got a normal structure.

The layer varying in depth from 25 to 35 cm, which is heavier, is composed of angular elements and is consequently highly permeable.

Here, too, all FeS has been oxydised by aeration, without visible iron-deposits being formed.

Owing to their sandy nature the deeper lying sandy loam shows no crack-formation. On account of the great compactness of this very fine sand, these layers have not yet been wholly areated.

The peat detritus, on the other hand, which is very rich in water, is cracked to a considerable extent. Along the cracks of this soil, which is non-calcareous and often highly acid, prominent iron-deposits are found. At the bottom of the profile the Würm-glacial sand may be seen.

THE ISLAND OF KAMPEN

Introduction

Under the influence of the old Hanseatic town of Kampen, the delta of the river IJssel developed into a territory that is interesting in many respects.

When after the formation of the IJsselmeer, the sea pushed forward to Kampen, the territory, where now the Kampereiland (Island of Kampen) stretches crescent-shaped around the town, was an area of marshes and shoals, through which the river followed many channels to the sea. Endowed by the Church, about 1250, with some of these wildernesses and flats, Kampen greatly extended its claims to the northern part of the Island at the partition of the polder of Mastenbroek, where Kampen had rights. The share of the town, which this time again consisted of reed-land and wildernesses, will, no doubt, have then seemed to be a bad dispensation of alms, but it became the foundation of great wealth. The islands which, by accretion, came gradually to form one whole, remained the undivided property of the community, to which the citizens obtained a right of use, which to the present day still exists as the Great Civil Right, now that the municipality have taken over the rights of the former municipal organs, and the remaining possessors of this right, about a hundred in number, enjoy great privileges as to the renting of the land.

The islands did not lie high and for a long time the dikes around the Island of Kampen proved to be insufficiently high to stem the onslaught of the floods during storms. In consequence of this, a type of holding came into existence which was suited to inundations and deposition of silt. Drainage by means of mills was known, however, since 1767. Drainage is well regulated now, but at this moment there threaten to be too deep water-stages in consequence of the flowing away of the water to the deep polder of Mastenbroek and the North-east polder. In the historical origin of the soil, of the legal relations, and of the agricultural customs, we must look for the cause of much that may now be considered as an improvement of this area.

The fact that the holdings are the property of the town of Kampen has promoted the preservation of too large farmsteads. The meadow-rights of the townsfolk facilitated the establishment of farms in the town. Now these town-farms have to be vacated, and a new division of the holdings is aimed at, in order to procure new home-steads for the town-farmers. At the same time the too large holdings will have

to be split up, because lack of soil and a shortage of labour lead to too extensive a use. A re-allotment will have to be carried out.

The ever-recurring inundations of former years have shaped the industrial form entirely to grassland. In consequence of the structure of the landscape under the influence of the sea, as to shoals, and under the influence of the river, as to silted up ditches and natural levees, soils have come into being that are better suited for other use than for grassland. The natural levees will have to become crop-land, the best types will be able to produce fruit. A soil survey may give a lead for a better use of the soil.

The unequal situation, the difference in the most desirable depth of drainage, and the carrying off of the water to the subsoil and the adjacent deep polders have made the problem of the most desirable depth of drainage arise, now that inundations are no longer to be feared. For this purpose an inquiry is made into the movement of the groundwater level, while, at the same time the most desirable depth of drainage is being examined on many experimental spots.

Finally, the extensive working-method, along with the omission of the former inundation that recurred regularly and that was highly appreciated, have led to an impoverishment of the soil. The conservative mentality, so often ascertained in the areas of inundation, together with a professional knowledge that has not been kept abreast of the times, also contributes to an insufficient and inexhaustive application of all the possibilities of productivity of the land.

Much advisory work will have to be done here by the Agricultural Advisory Service. The chemical soil-research and an insight into the value of the grassland may constitute the basis for some valuable extra information for the attainment of this end. These data, too, were collected.

The operations form the task of the Government Service of Drainage, Land-Improvement and Reallocation and are prepared in concert with all the experts, in the very first place with the Agricultural Service of the town of Kampen, in order to arrive at plans of improvement in due course.

The excursion

Attention is invited for the typical delta-landscape intersected by river-arms with farms, standing by themselves on dwelling-mounds ("terps") in the grassy plain, surrounded by girdles of trees. The farms, about a hundred in number, which are the property of the town here, are partly very old. In former years the business was shaped to a large extent to

the making of hay for sale as such. The hay-ricks behind the farms form a striking feature.

One of the oldest farms, on which Mr Van der Kolk pursues a progressive industry, will be inspected. This farm, known as holding nr. 28, is situated on the natural levee of a river-arm, the „Garste”, that is wholly silted up.

The soils belonging to this holding will give a picture of what will in the main be found in the Island of Kampen. Close along the farm runs the old „Garste”. A striking feature is the river-bed, lying deeper between the natural levees and having a wetter grass-surface. This soil should be drained to a great depth, but on account of the fact that it is situated in a low position, it cannot but be drained to a slight depth. This soil will be capable of being worked as moist grassland only, owing to its low position and consequently requires special care.

The profile is represented by the following code of description:

Depth below surface	Fraction <16 mu	Colour		Humus %	Remarks
		gray	red/black		
0 cm					
10 cm	49	2 gr	-/-	20	
15 cm	42	4 gr	tr/-	16	shells
30 cm	54	gr	1/-	12	plant remains
45 cm	58	d gr	2/-	22	plant remains
55 cm	60	bl gr	1/-	31	plant remains
150 cm	65	bl gr	tr/-	40	plant remains

tr = trace

This field-description always indicates the depth of the lower side of each layer. The thickness of the layer produces the difference. In the field the silt-content is estimated with the constant error of 3 points. It is tried to give the particle-content smaller than 16 mu. The humus content also estimated, possesses a much greater inaccuracy, to be taken at 20 % of the amount of estimation. The colour is distinguished as grey reduction and red-black oxidation tints. For both the scale runs from 1 to 5, at which the reduction colours are indicated, supplemented with brown and quite grey (gr.), together with dark grey and bluish-grey. Slight colour-intensities are indicated by: trace — tr.

The profile seems to contain heavier clay with a highly humous character towards the deeper layers. Total reduction makes its appearance already high up in the profile. The

profile of the river-bed will be difficult of drainage and hard to improve on account of its restricted area.

Along the „Garste” a high natural levee is found opposite the farm. The high situation, the slight thickness sometimes of the layer of silt, and the coarse subsoil-sand are the causes that these profiles are mostly too dry. That is why these soils are mostly more reliable for arable land crops than for grassland, which, especially in autumn, yields too little. The profile given is, however, no example of the strongly drying up cases within this type, seeing the thickness of the silt-containing layer.

The description of the profile in code has the following aspect:

Depth below surface	Fraction <16 μ	Colour		Humus %	Specific surface
		gray	red/black		
0 cm	26	2 gr	— /—	7	95
15 cm	22	3 gr	tr /—	4	
25 cm	17	4 gr	tr /—		85
35 cm	12	5 gr	1 /—		85
50 cm	sand	gr	tr /—		65
60 cm	sand	d gr	tr /		75
70 cm	sand	d gr			120
78 cm	sand	gr			60
95 cm	35	d gr			
105 cm	35	gr	1½/—		65
115 cm	35	gr			55

The specific surface gives a measure for the coarseness of the sandy part of the silt-fraction, a value, which can only be estimated in the case of low silt-contents and coarse-sandy material. The profile has a fairly thick, silt-containing layer, a normal humus-content for these soils, and is rather coarse in the subsoil. Complete reduction only makes its appearance at a fairly great depth. The profile shows all the characteristics of good drainage. The small layer of 70-78 cm give an indication of a temporary influence of the sea. The profile may produce a highly suitable arable land with little chance of drying up. In fact a parcel of arable land is seen on the natural levee. For grassland this soil will also be well usable.

On the south-side of the farm we approach the area of the old shoals in the sea. The profile shown does not give the most characteristic picture of this type, but was chosen as a fairly good representative with a view to the distance. These

soils mostly belong to the heavy sandy clay soils and have a fine-sandy to silt-containing subsoil. The height-situation mostly forms the average between the river-bed soils and the natural levee soils. The depth of drainage is in connection with it also the average.

The description in code is as follows:

Depth below surface	Fraction <16 mu	Colour		Humus %	Specific surface
		gray	red/black		
0 cm	42	2 gr	-/-	8	
15 cm	36	3 gr	tr/-	4	shells
25 cm	28	4 gr	1 /-		shells
40 cm	22	5 gr	tr/-		
60 cm		gr	4 /-		60
85 cm		bl gr			120

The high silt-content in the top-soil and the sandy deeper layers stamp these soils as the best profile-type in the Island. Properly speaking, this soil is much too good for the somewhat extensive meadow industry. Of this soil type, the population will be able to derive much advantage, when they will again have shaped themselves to agriculture.

Excursion: Inspection of a cattle-farm in the Island of Kampen in the delta-area of the IJsel, at which three profiles will be shown of the elements of which this area of riverarms and islands, silted up by the sea, has been built up.

Departure from Emmeloord by bus at 1.45 p.m. in the direction of Kampen.

1. Short explanation and inspection of the farm.
2. Profile I river-bed deposit.
3. Profile II natural levee, a river deposit.
4. Profile III shoal, a sea deposit.

EXCURSION WAGENINGEN IV – BETUWE

Subject:

River-clay soils in relation to fruit-growing.

References:

EDELMAN, C. H. (1950) — Soils of the Netherlands, Amsterdam.

EGBERTS, H. (1950) — Soil conditions in the Betuwe.

EGBERTS, H. (1950) — Soil Survey in the Netherlands Vol. VIII (in the press).

EGBERTS, H. — Various articles in „Boor & Spade” (Auger & Spade), Vol. I, 1948; Vol. II, 1948; Vol. III, 1949, with summaries in English.

EDELMAN, C. H. and Miss A. W. VLAM (1949) — Place-names in the Dutch River-clay Area, „Auger & Spade”, III.

MODDERMAN, P. J. R. (1949) — Archaeological Research of the Old Settlements in the Over- and Neder-Betuwe. Archaeological Communications from the National Museum of Antiquities at Leyden, New series XXX, pp. 66-93, with two maps.

EGBERTS, H. (1948) — Soil Conditions in the Betuwe in relation to Fruit-growing. First List of Species for Fruit. Publishers: Dutch Fruit-organization. District: "Rhine and Waal", pp 4-8 (only in Dutch).

Appendixes:

General Soil Map of the Betuwe (map 6).

Legend of map 6:

Rs	sandy river-ridge clay
Rsk	sandy river-ridge clay on basin clay
RskS	sandy river-ridge clay on basin clay on sandy river-ridge clay
Rk	basin clay
Rks	basin clay on sandy river-clay
Rksk	basin clay on sandy river-clay on basin clay
Ro	dike breach deposit soil
Ros	dike breach deposit soil on sandy river-clay
Rok	dike breach deposit soil on basin clay
Rosk	dike breach deposit soil on sandy river-ridge clay on basin clay
Rp	ancient settlement soil

Rsb river-channel clay
 Rd old sandy soil
 Refilled excavation.

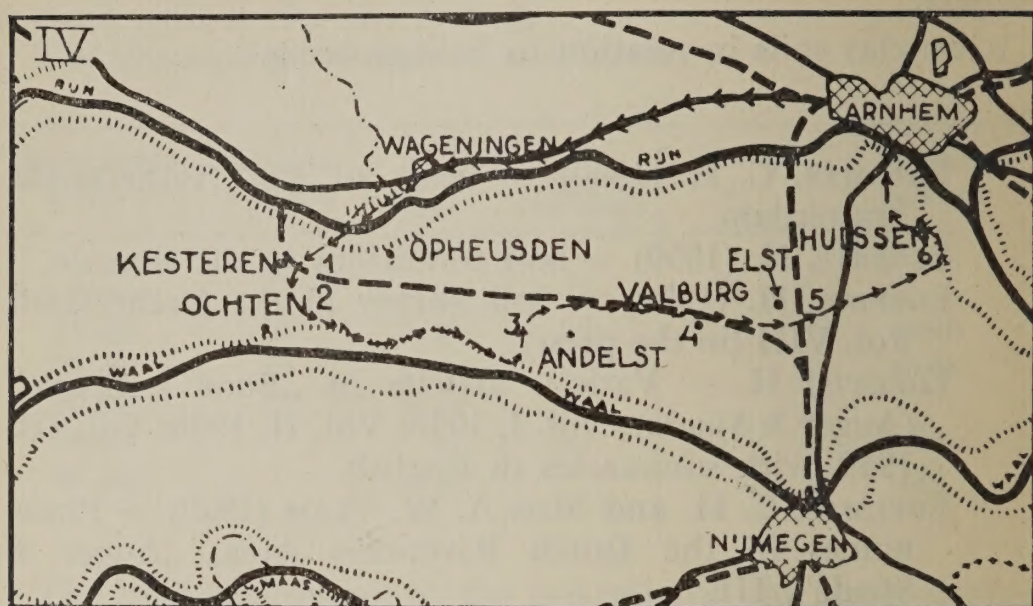


Fig. 11. Route-map

Excursion under the guidance of: H. EGBERTS, K. J. HOEKSEMA, J. J. JANTZEN and F. W. G. PIJLS.

Departure:

By bus from the Students' Club-house "Ceres", 1 Rijksstraatweg, Wageningen, at 8.30 a.m.

Lunch at Hotel „Veilingsvereniging Over-Betuwe” (Auction-Union Over-Betuwe) at Elst.

Return at Wageningen at 5.30 p.m.

EXCURSION PROGRAMME

A description of the soil conditions of the Dutch river-clay soils is given by Edelman, C. H. (1950): Soils of the Netherlands, chapter IV.

Route and excursion-points

From Wageningen via the Opheusden ferry across the Rhine to Kesteren. On either side of the road: tree-nurseries of the centre Opheusden and at your left buildings of the Experimental Garden „Boom & Vrucht” ("Tree & Fruit"), in which are established the fruit-growing school and the seat of a Government Horticultural Adviser.

1. Kesteren near the railway station.

Profile of a Rs3-soil, light to moderately heavy river ridge clay on clayey sand. Meadow of good quality. The orchards of this region show good growth, the cherries, too, are in good condition. In connection with the bad maintenance of the orchards the general picture is but moderately satisfactory.

Profile

- 0– 15 cm top soil, brown clay, slightly rusty, Mn-spots, coal-remnants of a compost manuring
- 15– 90 cm greyish-brown clay rust and Mn-spots, strongly root-interspersed, nut-structure with sharp faces, worm-channels
- 90–118 cm clay-containing grey sand with many rust-stains and Mn-spots, a few, fine plant-roots, worm-channels
- 118 + cm fine-sandy clay, grey, very rusty, small shells, remnants of plants, small Mn-spots. This horizon lies in the groundwater in consequence of which the structure is difficult to judge

2. Kesteren, Hoge Woerd.

Profile of an ancient settlement soil (Rp), raised, lying high in the landscape, rich in prehistoric potsherds and debris. In the subsoil yellowish-green iron-phosphate concretions. Meadow of a good quality. The old cultivation soil has been partly ploughed up.

Profile

- 0– 72 cm black, crumbly, very sandy clay, many roots and worm-channels, much debris (potsherds, bones, and coal-remnants)
- 72–100 cm very sandy clay, yellowish-brown and black mixed, nut-like, strongly rounded structure, coal-remnants, worm and root-channels
- 100–114 cm clay-containing sand, fair with some phosphate-stains and rust, root-channels and worm-channels, structure nut-like and rounded
- 114–134 cm brownish-grey, sandy clay with brown rust-stains and many phosphate-stains and worm-channels, nutlike structure
- 134 + cm light coloured, slightly silt-containing sand, locally yellowish-green due to the great amount of phosphate, sometimes in concretions, many worm and root-channels, groundwater not yet reached

To Ochten

On the dike of the river Waal a view of the foreland landscape with bar swales.

On the landside of the dike a view of the scour holes with the dike-breach deposit soils behind. A profile in the dike-breach deposit soils will be inspected in the neighbourhood of Huissen, excursion-point 6.

To Andelst and Valburg

Along the Waal-dike via Dodewaard and Hien. Attention is drawn to the peculiar position of the old churches.

3. Valburg.

Two profiles on either side of the road.

- a. House-orchard on the edge of the centre of the village on the „Hoog”.

Pleistocene upheaval (old sandy soil, Rd) on which formerly tobacco was grown (cultivation on little dams). Maintenance of orchard: moderate to bad, good growth.

Profile

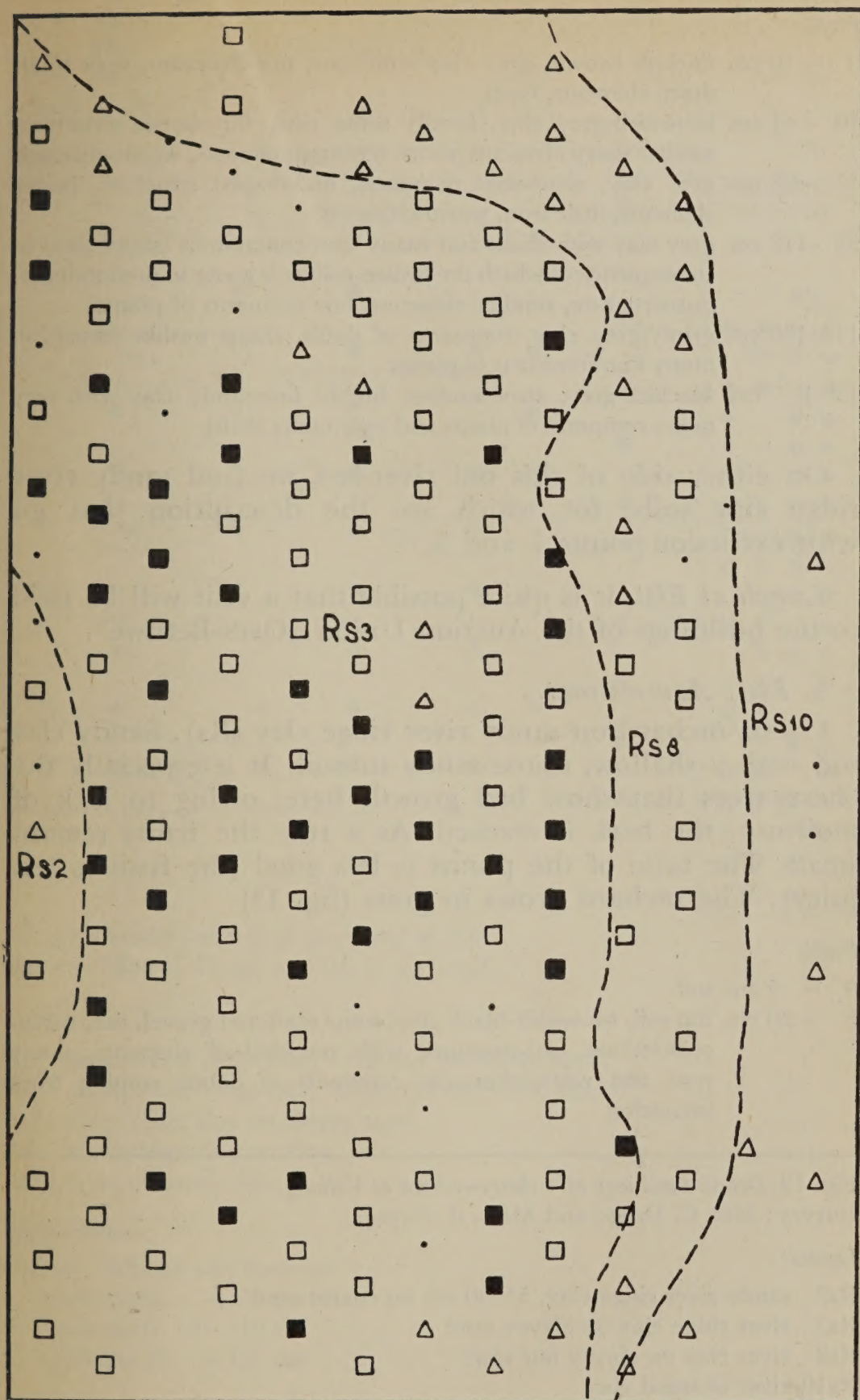
- 0 – 70 cm blackish-brown sand, containing some silt, crumbly, many roots and worm-channels, in the layer 0–20 cm root-interspersion is very marked, the transition to the next layer is sharp
- 70 + cm loose, medium-fine, yellowish-brown sand with small bands that are highly ferriferous and have a slightly darker colour, few roots, no worm-channels
- b. *Basin clay profile* (Rk) and a general view of large basin of Valburg. On account of the high situation on the edge of the basin area, drainage is favourable, in consequence of which the top of most horizons are slightly less grey in colour than is usually the case. It is used as an orchard. The condition of the pear-trees, though not grafted, is passable; that of the apple-trees very moderate.

Profile

- 0– 10 cm top soil, blackish-grey clay, nutlike structure with very small elements, highly root-interspersed, at the top a beginning of peat-formation of the sods
- 10 – 38 cm brownish-grey clay with little rust, many roots, nutlike structure with smaller, sharp elements, root-channels
- 38 – 80 cm grey clay with orange-coloured rust, nut-formation, sharp, roots, a few worm-channels
- 80 –132 cm grey clay, very many signs of rust in the form of Fe-grains (short clay), a few living roots, sharp, nut-shaped structure
- 132+ cm bluish-black clay, prismatic, many remnants of roots with bright, orange-coloured rust along the root-channels, ground-water at 100 cm

4. From Valburg to Elst.

At the roadside from Valburg to Elst a cherry-orchard in which lies an old river-bed with river-bedclay (Rsb). Owing to the lower situation, surface water is attracted. On the river-channel clay most cherry-trees are dead or have been planted anew. The orchard is situated in grassland (fig. 12).



1 $\triangle$ 2 $\square$ 3 $\blacksquare$ 4 $\cdot$

0 10 20 30 m

For the legend see page 74

Profile

- 0 - 10 cm darkish brown, grey clay with rust, nut-structure, very small sharp elements, roots
- 10 - 41 cm brownish-grey clay, locally some rust, nut-shapes structure, smaller sharp elements, roots, remnants of roots, worm-channels
- 41 - 93 cm grey clay, somewhat prismatic, nut-shaped structure, larger elements, little iron, worm-channels
- 93 -113 cm grey clay with shells and many iron concretions (short clay) in consequence of which the brown colour is going to predominate, nut-structure, smaller elements, few remnants of plants
- 113-136 cm grimy-grey clay, remnants of shells, sharp nutlike structure, many fine remnants of plants
- 136+ cm blackish-grey, structureless, highly fine-sandy clay with very many remnants of plants and very many shells

On either side of this old river-bed we find sandy river ridge clay soils, for which see the description that go with excursion-points 1 and 5.

Lunch at Elst, it is quite possible that a visit will be paid to the buildings of the Auction Union „Over-Betuwe”.

5. Elst, Aamsestraat.

Cherry-orchard on sandy river ridge clay (Rs). Sandy clay soil with a shallow, coarse-sandy subsoil. It is especially the cherry-trees that show bad growth here, owing to lack of moisture; the bark is cracked. As a rule the fruits remain small. The taste of the plums is less good (the fruit is less juicy). The orchard grows in grass (fig. 13).

Profile

- 0 - 5 cm sod
- 5 - 20 cm top soil, brownish-black clay, some scattered gravel, many Mn-concretions, nut-structure with rounded-off elements, many root and worm-channels, remnants of debris coming from manuring

Fig. 12 *Detailed soil map of a cherry-orchard at Valburg*
(survey: Miss C. Dröge and Mr v. d. Geyn)

Legend:

- Rs2 sandy river ridge clay, 55-90 cm on coarse sand
 - Rs3 river ridge clay on clayey sand
 - Rs8 river clay on clayey fine sand
 - Rs10 river channal clay
 - 1. trunk girth <75
 - 2. trunk girth 76-89 cm
 - 3. trunk girth >90 cm
 - 4. Other cherry varieties (not measures)
- } variety Meikers
- (The trees are measured at an altitude of abt. 1.60 m)

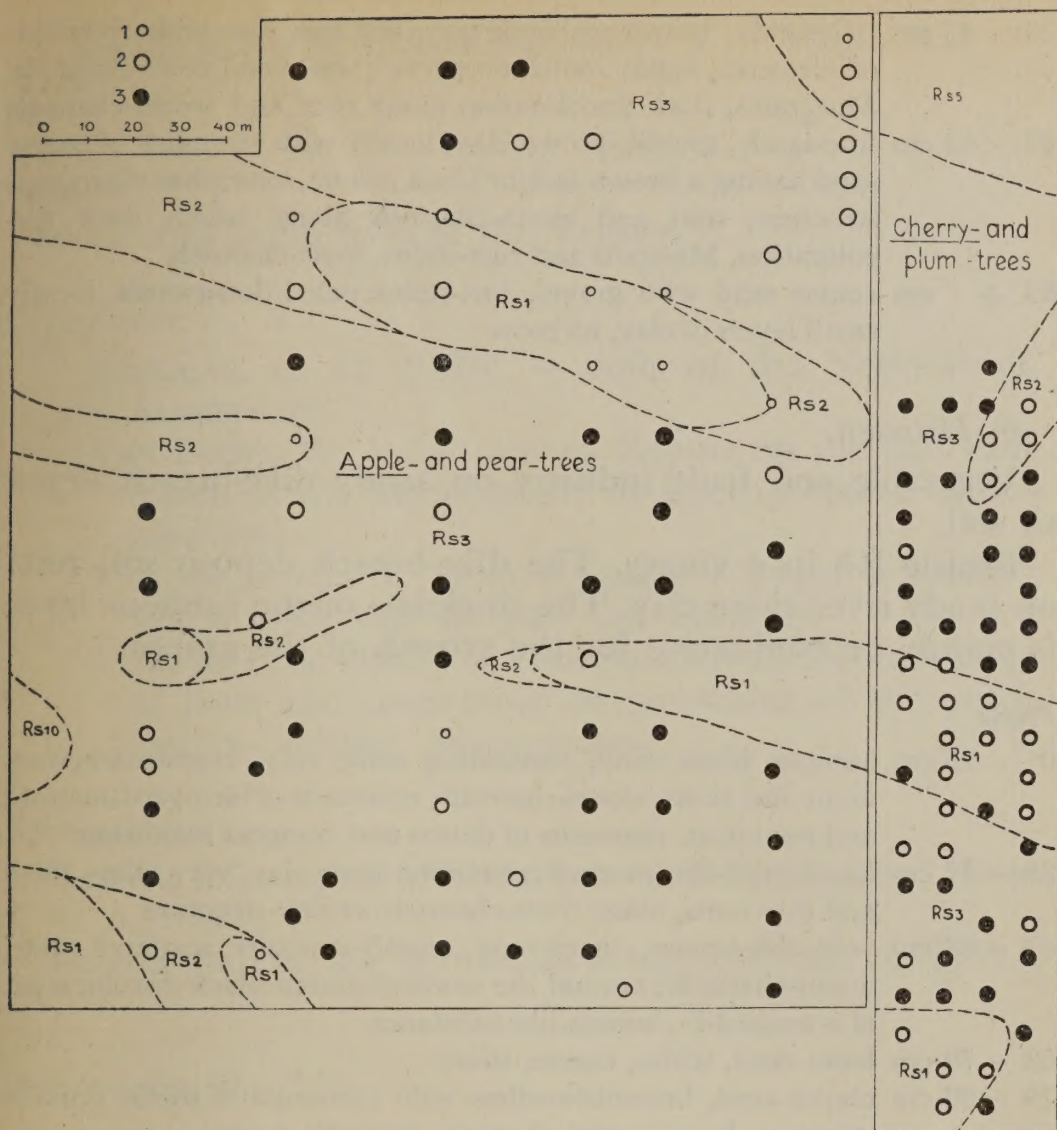


Fig. 13 Detailed soil map of an orchard at Elst
(survey: Miss C. Dröge and Mr v. d. Geyn)

- 20 - 43 cm fine-sandy, brown to black clay, nut-structure with rounded-off elements, highly root-interspersed, worm and mole-channels, Mn-grains, dark discoloration along root and worm-channels
- 43 - 63 cm fine-sandy, greyish-brown clay, locally with remnants of coarse sand having a brown and/or black colour, somewhat sharp nut-structure, root and worm-channels along which dark discoloration, Mn-spots and rust-stains, mole-channels
- 63 + cm coarse sand with gravel, rust-stains paled downwards, locally small layers of clay, no roots

6. *Huissen.*

Vegetable and fruit industry on sandy dike-breach deposit soil.

Profile Ro in a vinery. The dike-breach deposit soil rests on sandy river ridge clay. The thickness of the humous layer is mainly determinative for the growth of the grapes.

Profile

- 0 - 25 cm humous black sand, containing some clay, crumb-structure, many fine roots, worm-channels, remnants of farmyard-manure and peat-dust, remnants of debris and compost manuring
- 25 - 47 cm black, pale-brown sand containing some clay, very many thick and thin roots, many roots-channels, crumb-structure
- 47 - 68 cm yellowish-brown, clayey sand, crumb-structure, scattered roots, worm-channels; around the worm-channels black discoloration of a washed-in, humus-like substance
- 68 - 79 cm loose sand, white, coarse, sharp
- 79 - 98 cm clayey sand, brownish-yellow with remnants of shells, crumb-structure, loose, worm-channels, sporadic roots
- 98 - 103 cm loose, coarse river-sand (this is found only locally)
- 103+ cm fine-sandy clay, firm, crumb-structure, brownish-grey with iron and manganese stains, a few worm-channels and shells

From Huissen back to Wageningen

During the drive explanation of the town-planning conflict between Arnhem and Huissen. The extension of the town of Arnhem on the reserve-grounds of Huissen has been prevented, inter alia, with the aid of the data of a soil survey.

Via the bridge across the Rhine to Arnhem, from there via Oosterbeek, Heelsum, and Renkum to Wageningen.

EXCURSION WAGENINGEN V – VELUWE

Subject:

Forest and heath soils of the Veluwe.

References:

EDELMAN, C. H. (1950) — Soils of the Netherlands, Amsterdam.

VAN LIERE, W. J. and others, Report on the Soil Condition of the Municipality of Epe (in course of preparation).

Various articles in „Boor & Spade” (”Auger & Spade”) Vol. I 1948; Vol. II 1948; Vol. III 1949.

VINK, A. P. A. (1949) — Contribution to the knowledge of loess and cover-sands in particular of the south-eastern Veluwe, Wageningen.

Appendixes:

Detailed soil-map of „Middachten and Beekhuizen” (Vink A. P. A.). Map 8.

General map of the Veluwe loess region (Vink, A. P. A.). Map 9.

Route-map (fig. 14).

Excursion under the guidance of: C. H. EDELMAN, J. E. M. VAN NISPEN TOT PANNERDEN, G. G. L. STEUR and L. A. H. DE SMET.

Departure:

By bus from the Students' Clubhouse „Ceres”, 1 Rijksweg, Wageningen, at 8.30 a.m.

Lunch: at hotel Bloemink, near the Royal Palace, at Apeldoorn.

Return at Wageningen: at 5.30 p.m.

Get out at the Students' Clubhouse „Ceres”.

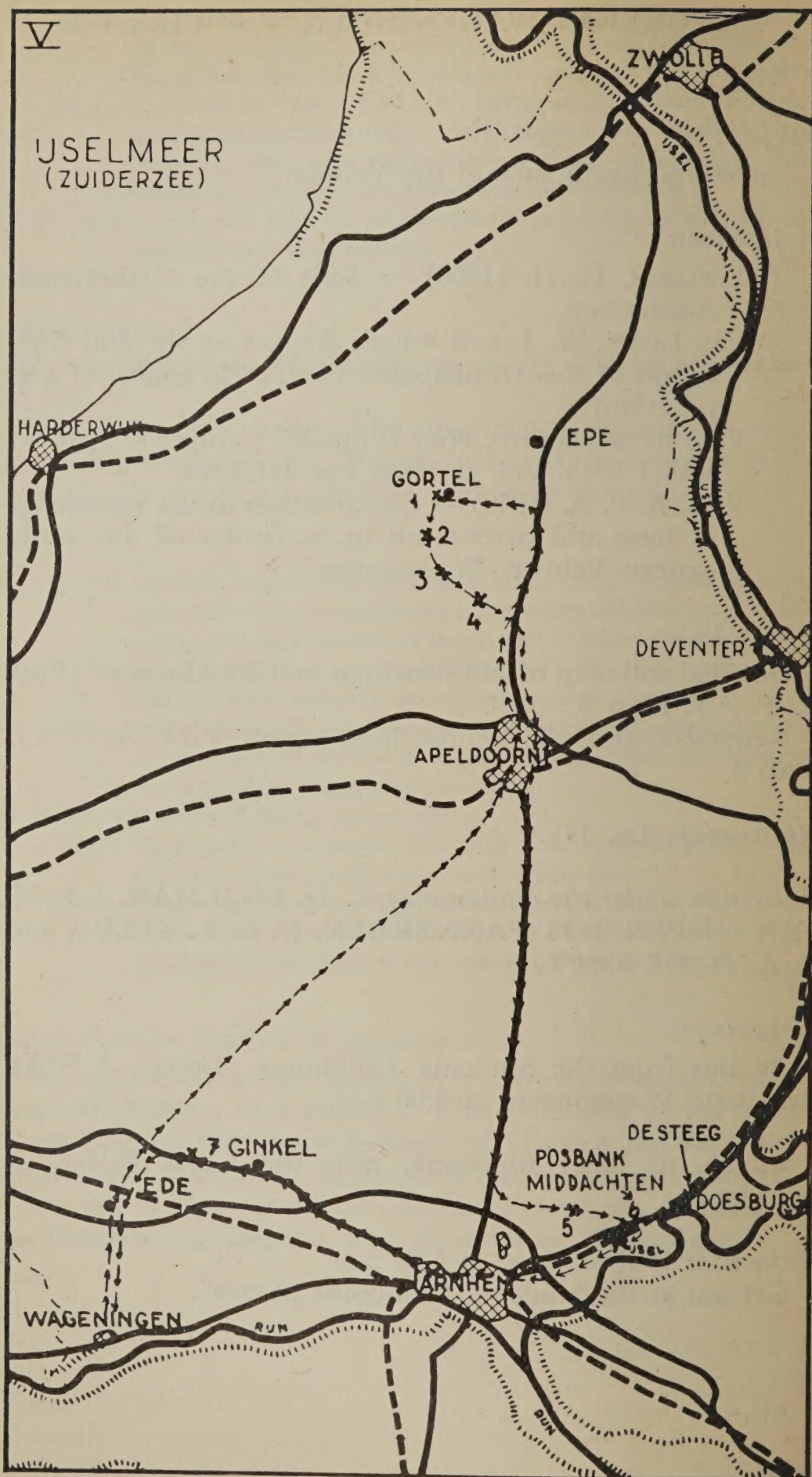


Fig. 14. Route-map

EXCURSION-PROGRAMME

A description of the pedology of the Dutch forest and heath soils is given in: Edelman (1950) "Soils of the Netherlands", chapter III.

Route and excursion points

Departure:

From Wageningen via Ede-Otterlo-Uchelen-Apeldoorn, Vaassen-Emst (near Epe) -Gortel. Along the route across the Veluwe between Ede and Otterlo shifting sands and soil erosion from the past.

1. *Near Gortelse Berg (Epe)*

Forest and heath profiles on different soils.

a. *Profile:* marked heath-podzol on pure sand.

Vegetation: Lichens (*Cladonia* spp.). Ling (*Calluna vulgaris*). Upgrowth of a few Scotch pines (*Pinus sylvestris*).

Profile: The whole profile consist of coarse, loose sand

- A₀ 0 – 2 cm horizontally stratified, undecayed heath-humus, lying loosely on the A₁
- A₁ 2 – 4 cm black, humous, coarse sand with remnants of roots
- A₂ 4 – 29 cm leached, grey, coarse sand with remnants of roots
- A₃ 29 – 31 cm slightly darker-coloured (greyish-black) horizon, transition into B₁ horizon
- B₁ 31 – 36 cm black, more or less cemented accumulated layer, „hard pan”; locally yellow spots from recent roots of Scotch pines
- B₂ 36 – 39 cm brownish-black illuvial horizon; locally yellow spots from roots of Scotch pines
- B₃ 39 – 54 cm dark brown horizon; locally yellow spots from roots of Scotch pines
- B₄ 54–110 cm light brown horizon; locally yellow spots from Scotch pines; brownish-black heath-fibres
- C(G) 110+ cm yellowish-white sand, at the bottom gley phenomena

b. *Profile:* greyish-brown forest soil on sand containing some silt (weak podzol-profile).

Vegetation: *Molinia coerulea*, *Erica tetralix*, *Calluna vulgaris*.

Upgrowth of *Quercus pedunculata*, *Pinus sylvestris*, *Salix* spp.

Slightly loamy forest soil, lying in the NE-SW direction of the pushed pre-glacial landscape. The profile is situated near an old loam-pit. It is strongly interspersed with *Molinia*.

roots. Most roots occur in the uppermost horizon of 50 cm. It is a lumpy, balling (binding) soil, consisting of moderately coarse sand with a slight admixture of finer material.

Profile

- A₀ 0 – 5 cm humus-layer of *Molinia*, greyish-brown when dry, blackish brown when wet, with some leached grains, firmly attached to the A₁
A₁ 5 – 35 cm dark brown, humous, slightly loamy moderately coarse sand
C₁ 35 – 90 cm yellowish-brown, slightly loamy moderately coarse sand
C₂ 90 – 92 cm brown fibre in moderately coarse sand
C₃ 92+ cm yellowish-brown, slightly loamy moderately coarse sand

Attention is drawn to the great difference in the wild vegetation between profile *a* and *b*.

2. To Gortelse Bos (Epe).

Profile: brown forest soil on pre-glacial loam under an old beech-wood.

Vegetation: 127 year old beeches and sessile oaks (*Fagus sylvatica*; *Quercus petraea*).

The profile is a part of the pushed pre-glacial having a NE-SW direction. It is a good, lumpy, clinging and balling (binding) soil. In the neighbourhood an old loam-pit.

Profile

- A₀ 0 – 7 cm loose humus, lying loosely on A₁
A₁ 7 – 10 cm purplish-brown, loose, loamy, fine sand (beech-oak colour)
C 10 – 50 cm brownish-yellow, loose, loamy, fine sand, root-interspersed
C(G) 50–70cm slightly reddish-brown-yellow, rusty, firmer, loamy, fine sandy layer with lighter spots of brownish-yellow, loose, loamy, fine sand
C 70–150 cm yellowish, loamy, fine sand

3. To Niersen "Nursery-garden".

Old arable land. The profile has become very humous and dark as a result of continued organic manuring (farmyard-manure and sheep-dung).

Profile

- A₀ 0 – 40 cm black, humous, coarse sand
A₁ × B₁
40 – 58 cm blackish-brown and yellow, patchy, coarse sand, so-called broken podzol
C(G) 58+ cm pale yellow, coarse sand with here and there thin small horizontal layers of loam (thickness about 5 mm); in the subsoil iron fibres

4. *To Apeldoorn.*

Heath-reclamation near the wood, patchy sand, poor profiles.

Lunch at Hotel Bloemink at Apeldoorn.

After lunch from Apeldoorn in the direction of Arnhem.

Via Beekhuizen, Zypenberg to the Posbank near De Steeg.

5. *Posbank.*

General view of the landscape, heath on loess, coversand and gravelly pre-glacial sand.

From the Posbank to De Steeg.

6. *De Steeg, Mestweg, Middachten.*

Wood-profile on loess-loam under a beech-wood.

Vegetation: Oaks and beeches about 150 years old (*Quercus pedunculata* (Ehrh), *Fagus sylvatica*).

Profile

A₀ 0– 3 cm stratified, undecayed humus

A₁ 3–10 cm dark purplish-brown humus infiltration in loess-loam

C₁ 10–45 cm brownish-yellow, highly root-interspersed loess-loam

C₂ 45–55 cm old, decayed sod; greyish-purple loess-loam containing humus

C₃ 55+ cm like C₁, but fewer roots

From De Steeg via Arnhem in the direction of Ede to De Ginkel.

7. *Ginkel, municipality of Ede.*

a. Redsand.

Vegetation: *Polytrichum* spp., *Calluna vulgaris*, *Quercus rubra* (Duroi), *Pinus sylvestris*.

Profile

0– 5 cm upturned sod, raw humus with some fine sand

5–18 cm grey, slightly leached, loose, moderately fine sand with light brown specks; root-interspersed

18–37 cm reddish-brown, moderately fine sand with some grey and red spots; root-interspersed

37–61 cm red, fine sand, somewhat firmer than deeper layers; root-interspersed

61–82 cm pale red sand with root-channels; alternating with yellowish-white sand; transitional zone

82+ cm yellowish-white, fine sand

b. Ordinary podzolic soil.

Vegetation: *Polytrichum* spp., *Dicranum scoparium*, *Calluna vulgaris*. Undergrowth of *Pseudotsuga Douglasii*, *Quercus* sp., *Pinus sylvestris*.

Profile

- 0- 9 cm turned-down sod, raw humus with some fine sand
- 9-18 cm grey, humous, slightly leached, loose, moderately fine sand, root-interspersed
- 18-35 cm dark brown, somewhat humous, moderately fine sand, locally with lighter spots from roots; root-interspersed
- 35-64 cm dark brownish-yellow, moderately fine sand with lighter spots; root-interspersed
- 64-85 cm pale brownish-yellow, moderately, fine sand
- 85+ cm yellowish-white fine sand; locally with brown rust-stains

From De Ginkel via Ede and Bennekom to Wageningen.

EXCURSION WAGENINGEN VI

NORTH LIMBURG AND RIJK VAN NIJMEGEN

Subject:

Soil formation and different stages of weathering on river deposits of different age.

References:

EDELMAN, C. H. (1950) — Soils of the Netherlands, Amsterdam.

SCHELLING, J. (1950) — A Soil Survey of North Limburg (in the press).

PONS, L. J. (1951) — A Soil Survey of Maas en Waal and a part of the Rijk van Nijmegen (in course of preparation).

Various articles in „Boor en Spade” (”Auger and Spade”) with summaries in English. Publishers: N.V. Oosthoek, Utrecht. Vol. I, 1948; Vol. II, 1948; Vol. III, 1949.

Appendixes:

General soil map of the environs of Nijmegen, Map 10.

Route-map see fig. 15.

Excursion under the guidance of: R. D. CROMMELIN, L. J. PONS, R. P. H. P. VAN DER SCHANS and J. SCHELLING.

Departure:

By bus at 8.30 a.m. from the Students' Clubhouse „Ceres”, 1 Rijksstraatweg, Wageningen.

Lunch: at Wychen, hotel de Kroon, Markt.

Arrival at Wageningen at 4 p.m., after which visit to the Laboratory for Agricultural Chemistry, 18 Herenstraat, Wageningen (Prof. Dr A. C. Schuffelen).

End of the visit at 6 p.m.

EXCURSION-PROGRAMME

For the general pedological description of the area, the reader is referred to: Edelman, C. H. (1950), Soils of the Netherlands, Amsterdam, Chapter IV.

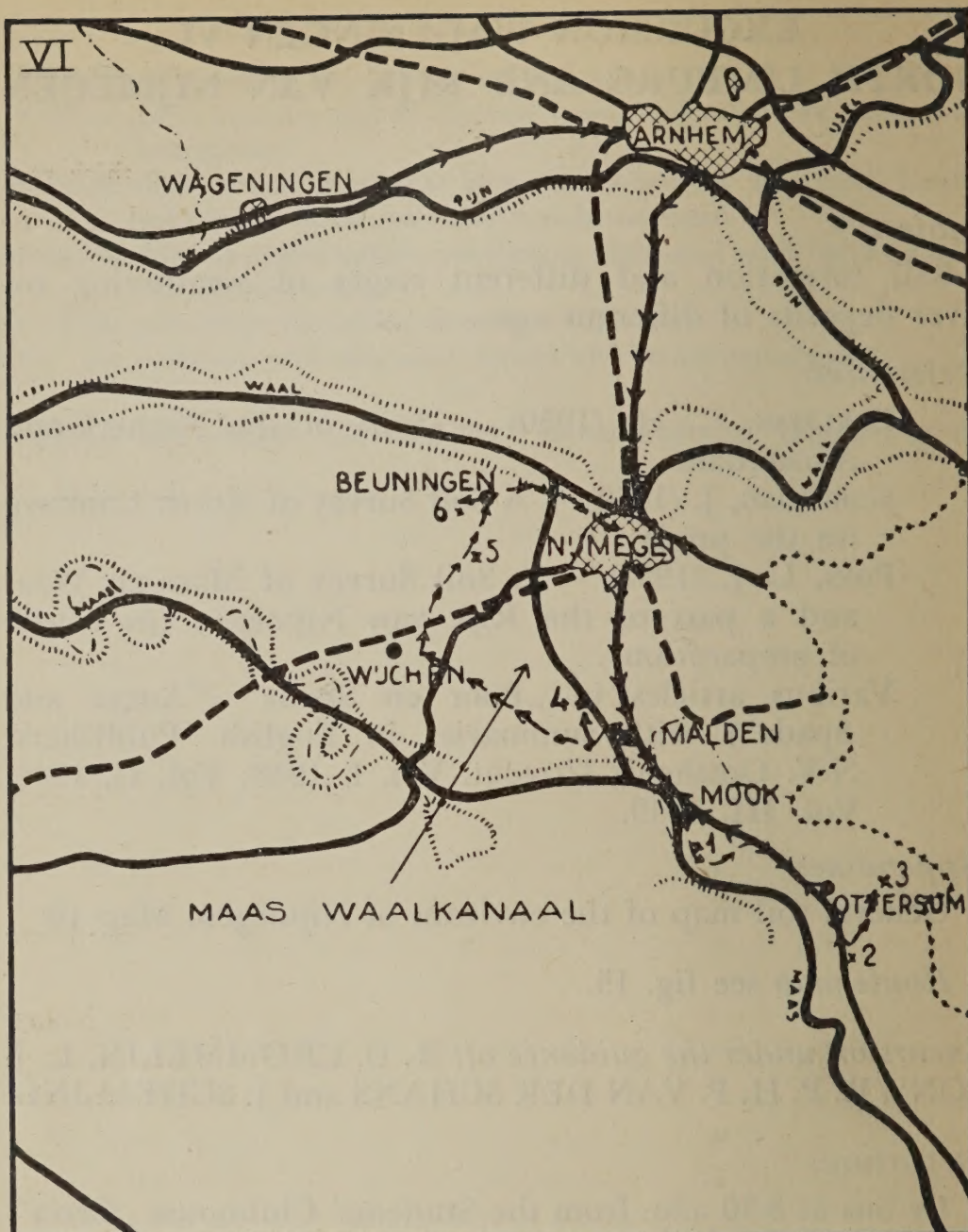


Fig. 15. Route-map

Route and excursion points:

From Wageningen to Arnhem, across the Rhine-bridge through the Betuwe and across the Waal-bridge to Nijmegen, from there along the push moraines to Mook and in the direction of Cuyck.

1. Along the road from Mook to Cuyck.

Near the Cuyckse Veer (Mook).

Young washland-clay deposits of the Meuse. High, non-calcareous, fine-sandy, brown washland-clay soil.

Profile

0-6 cm turf, greatly interspersed with roots

- 6–12 cm slightly brownish-black, crumbly, very fine-sandy clay
 12–52 cm root-interspersed, pale brown, soft, small nuts of very fine-sandy clay
 52–96 cm ditto, but slightly more compact, only few fine, some thick roots
 96+ cm pale brown, very soft nuts of sandy clay, only a single thick root

Via Katerbosch (Middelaar) across the blown sand area to the push moraine, cut into by the pleistocene Rhine, near the Plasmolen and from here across the blown sand to Ottersum.

2. *Near Ottersum.*

Sandy, brown river-loam of the wide pleistocene natural levee of a Rhine-arm. General view of the Niers, situated in a wide, old Rhine valley.

High, brown loam-soil. Meadow near Ottersum.

Profile

- 0–15 cm moderately root-interspersed, dark greyish brown, crumbly, coarse-sandy, light loam
 15–41 cm compact, little root-interspersed, greyish brown, very soft nuts, coarse-sandy light loam
 41–60 cm brown, slightly stiffer nuts, very little root-interspersed, fine-sandy loam
 60–96 cm alternate small layers of red-brown, coarse-sandy loam and very sandy loam to sand, very soft nuts
 96+ cm alternating small layers of yellowish grey, coarse, loose, sharp sand and cemented reddish brown sand

Via Mook along the push-hills. At Heumen the Maas-Waal canal is passed, after which the road runs along a large blown sand area. Here and there are bad reclamations, the rest is planted with fir-wood. Out of the blown sand area we get into the area of the pleistocene river-loam soils.

4. *Near Maldense brug, Malden.*

Low-lying, more or less reduced river-loam soils in and near a gully of the pleistocene braided Rhine system filled up with peat (see fig. 16).

a. River ridge along a deep gully, shallow variegated loam on sand.

Profile

- 0–14 cm greyish brown, moderately root-interspersed nuts, loam with reddish brown spots of rust, rather sharp nuts of about 0.5 cm
 14–40 cm grey loam with much (50–60 %) orange-brown rust, column structure falling apart into sharp nuts, rather strongly root-interspersed
 40–62 cm ditto, but having about 30 % of rust, softer nuts, sandy light loam very weakly root-interspersed
 62+ cm grey, structureless layer, slightly loamy sand

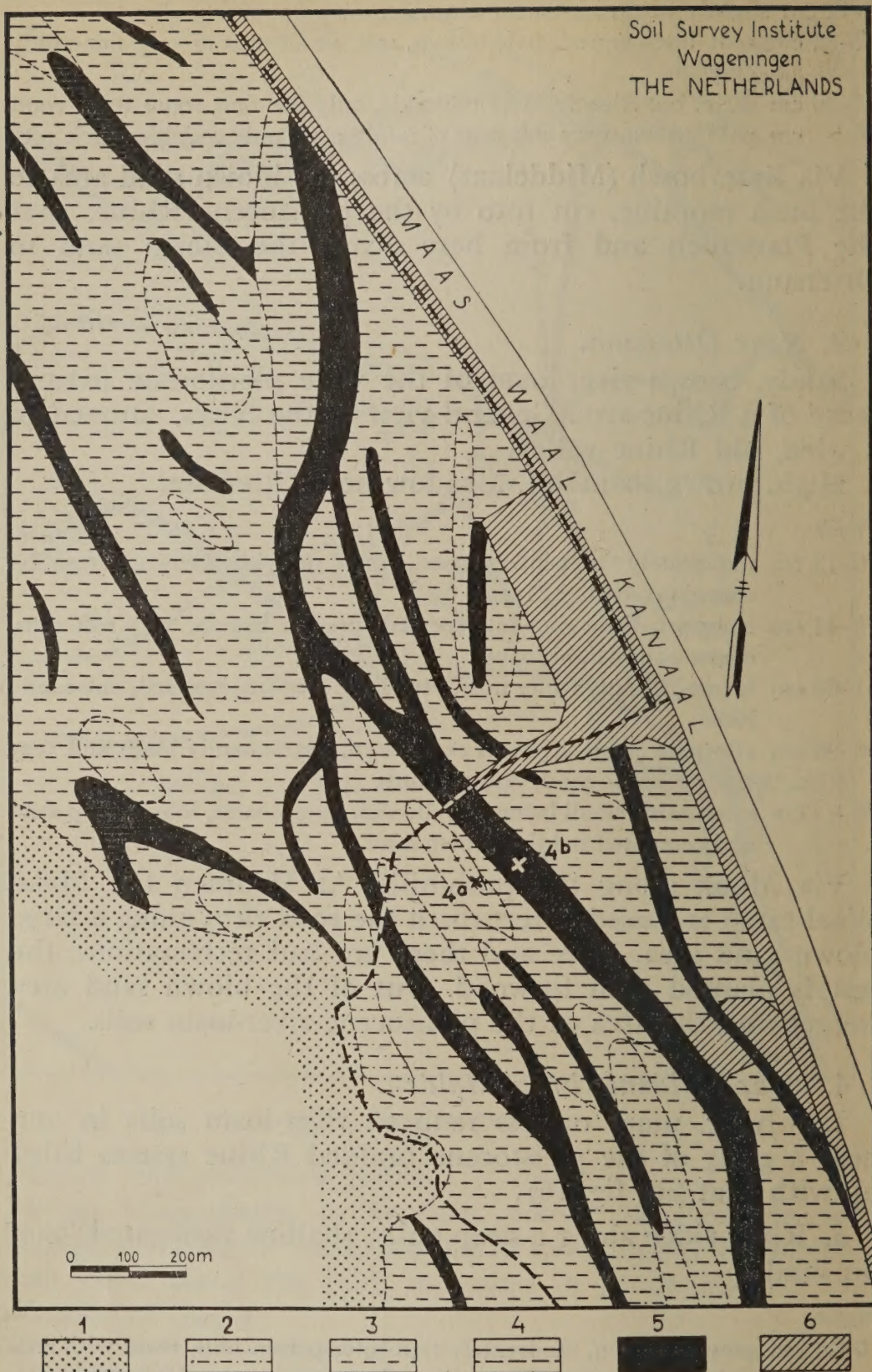
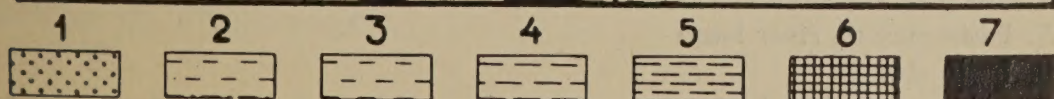
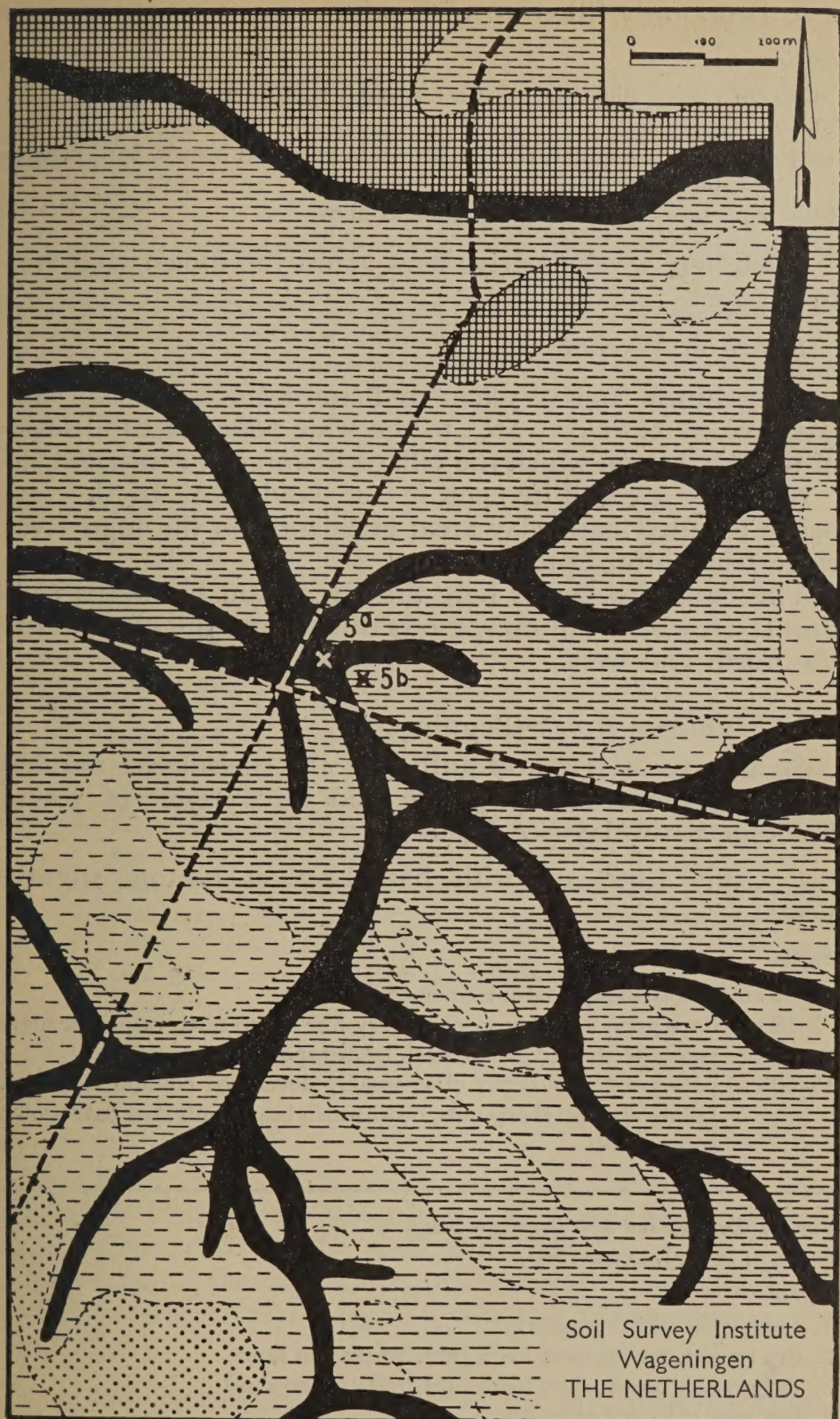


Fig. 16 *Detailed soil map Maldense Brug*
(survey Ir L. J. Pons, 1949)

1. sandy soils (shifting sand)
2. dry geyish-brown river loam (abt. 50 cm) on sand
3. dry greyish brown river loam (abt. 100 cm) on sand
4. low grey coloured river loam
5. beds of the braided river system filled up with peat or loam
6. hightened land



For the legend see page 88

b. Deep gully filled up with peat.

Profile

- 0-30 cm clayey, slightly sandy peat, strongly root-interspersed
30-40
or 45 cm friable, angular, reddish brown to yellowish brown, hard concretions with much Fe
40+ cm clayey forest peat, the same as above

From here we shall drive back across the blown sand area to Wychen.

Lunch at Wychen.

After lunch from Wychen to Beuningen, across the vast, flat, treeless basin-clay area to the wide young natural levee of the Waal upon which the village Beuningen is situated.

Note the great difference in the landscape! In the low heavy textured basin-clay area: grassland, on the high river ridge fruit-culture predominates.

The basin-clay covers here the river loam by means of a thin layer, which, however, grows thicker and thicker towards the north and west.

5. *Beuningse Broek* (Beuningen).

Small river ridges and gullies of the pleistocene braided Rhine system covered by thin and thick layers of young holocene basin-clay (see fig. 17).

a. Gully filled up with basin-clay, at bottom slightly peaty.

Profile

- 0- 7 cm turf strongly root-interspersed
7-18 cm dark grey, very heavy clay, very fine sharp nuts, rather strongly root-interspersed, small, dark brown spots of rust
18-60 cm pale grey, very heavy clay, weakly developed column structure, falling apart in sharp nuts, downwards larger nuts, few pale brown spots of rust

Fig. 17 *Detailed soil map Beuningse Steeg*
(survey: Ir L. J. Pons, 1949)

Legend

1. sandy soils (shifting sand)
2. dry greyish-brown river loam (abt. 50 cm) on sand
3. dry greyish brown river loam (abt. 100 cm) on sand
4. low grey coloured river loam
5. basin clay on river loam
6. basin clay
7. gullies of the braided river system filled up with peat or basin clay on peat

60–70 cm ditto, spotted in a dark grey colour, slightly humous, locally remnants of roots

70+ cm ditto, same as 18–60 cm

b. Loam covered up by a thin layer of basin-clay (on the same plot).

Profile

0–14 cm turf, dark grey, heavy clay, strongly root-interspersed, very fine nuts

14–32 cm grey, heavy clay with few palish brown spots of rust, sharp nuts, moderately root-interspersed

32–60 cm pale grey, heavy loam, weakly developed nutstructure, tough and sticky, many light brown spots of rust, 40 % of the surface, locally black Mn-spots

60–90 cm locally some scattered gravel and slightly sandier and greyer

6. „De Ouwel” (Beuningen).

Young, brown river ridge soil with medieval antiquities on slightly loamy, old, brown river ridge soil, deficient in lime, covered with antiquities from Roman times.

Profile

0–25 cm ploughed layer, dark greyish brown, fine-sandy, normal clay, small friable nuts, manure and medieval potsherds

25–52 cm greyish brown, fine-sandy, normal clay with yellowish green P-spots, small nuts, soft to the touch, well root-interspersed

52–60 cm layer of inhabitation, dark, humous clay with rust, charcoal, native and Roman potsherds

60+ cm pale grey, rather heavy, fine-sandy clay with 50 % of light yellowish-orange spots of rust and black Mn-spots, here and there yellowish green P-spots. Rather stiff and large nuts, fairly well root-interspersed, greasy, dryish stiff to the touch when in a wet condition

From here to Nijmegen and via Arnhem back to Wageningen.

4 p.m.

Visit to the Laboratory for Agricultural Chemistry of the University College of Agriculture, 18 Herenstraat, Wageningen. Director: Prof. Dr A. C. Schuffelen.

Inspection of the Laboratory (differential thermal analyses of clay, measuring of I.E.P., clay minerals and spectographic installation).

At 6 p.m. back to the Students' Club-house „Ceres”, 1 Rijksstraatweg, Wageningen.

EXCURSION BREDA VII – WALCHEREN

Subject:

Restoration of the sea clay soils of the island of Walcheren after the salt water inundation of 1944-45.

References:

EDELMAN, C. H. (1950) — Soils of the Netherlands, Amsterdam.

BENNEMA, J. and K. VAN DER MEER — Pedological Report on Walcheren (in course of preparation).

„Boor & Spade” (”Auger & Spade”) — Various contributions, Vol. I, 1948; Vol. II, 1948; Vol. III, 1949.

HOOGHOUT, S. B. (1937) — Die Bohrlöcher methode zur Ermittlung der Durchlässigkeit des Bodens und ihr Nutzen für die Praxis (Transactions of the Sixth Commission of the Intern. Soc. of Soil Science, Zürich, Vol. B).

Appendix:

Simplified soil map of Walcheren (Map 11).



Fig. 18. Route-map

Excursion under the guidance of: J. BENNEMA, J. H. BOUMANS, J. BUTEYN, C. VAN DEN BERG and K. VAN DER MEER.

Start by train from Breda to Middelburg, then excursion by bus on Walcheren, and back from Middelburg to Breda by train.

Lunch at Domburg at the „Walcherense Dolfijn” hotel.

EXCURSION-PROGRAMME

As for the pedology of this area, the reader is referred to Edelman, C. H. (1950): *Soils of the Netherlands*, Amsterdam, chapter VII.

At Breda Mr A. Franke, advisory expert for land-improvement in the province of Zeeland, will give an introductory explanation for each group of the land-improvement work on Walcheren. At the same time a moving picture of this work will be shown.

In the first place two profiles will be demonstrated, from which an idea may be formed about the structure of the soil of Walcheren.

1. *North-West of Middelburg*

Close to each other two quite different soil profiles.

a. Creek ridge soil (silt)

(lying high in the landscape)

- 0 – 15 cm ploughed layer, greyish, abt. 27 % < 16 μ
- 15 – 37 cm light grey, sandy clay with many brown small rust spots, abt. 25 % < 16 μ , calcareous
- 37 – 61 cm sandy clay, abt. 28 % < 16 μ , many brown rust spots and calcareous
- 61 – 84 cm slightly sandier clay, abt. 26 % < 16 μ with many rust spots and calcareous
- 84 – 100 cm grey sand with little yellowish-brown, flamed rust, abt. 8 % < 16 μ

b. Pool soil (clay on peat)

(lying low in the landscape)

- 0 – 10 cm brown sod
- 10 – 25 cm grey clay with many reddish-brown rust spots, abt. 55 % < 16 μ , non-calcareous
- 25 – 100 cm clay with peat remnants, bluish-grey, abt. 55 % < 16 μ , non-calcareous
- 100–110 cm peat
- 110–120 cm humous, old sea clay, abt. 45 % < 16 μ

2. *Re-allotment Walcheren*

Then we drive on to Koudekerke, where re-allotment is in

full swing. Simultaneously with the restoration of the island, the devastated areas are being re-allotted. The land is again divided into parcels, new ditches are dug, many roads are constructed anew. The operations will be viewed and explained from out the bus.

During the last few years many research-workers have been studying all kinds of problems that are connected with a work of such a great extent. Two of them will be inspected. *The drainage of the soil.*

At the outset, when making plans for drainage and ascertaining the denseness of the network of ditches and drains, it was the doubtless valuable practical experience that was depended upon. According as, however, agricultural science progressed, the need of a sounder basis came to the fore. The requirements which are now being set up as to the water regulation in Holland, render the knowledge of the permeability of the soil and of the laws governing the groundwater movement, an indispensable data when drawing up plans for drainage and water-control.

In this country Dr S. B. Hooghoudt has been able to demonstrate in a practically applicable and theoretically justified way, the connection between drain-distance and drain-depth with the permeability of the soil, by a further development of the current-theory. At the same time he worked out a method for measuring the permeability directly under field-circumstances. By this method it has become possible to replace the subjective drainage-advice, relying on a more or less practical experience, locally present, by an instruction depending on an objective examination.

It took, however, a rather long time before application on a large scale could be thought of. An initial drawback was the comparatively intricate apparatus, of difficult portability in the field, which was used for measuring the permeability.

By Prof. M. F. Visser the apparatus has been simplified and rendered adaptable to practical requirements. At present the Government Service for Drainage, Land-Improvement and Reallocation makes regular use of the results of permeability-measurements, when giving drainage-advice. It is mostly small, individual cases for which advice is required; in a single case, however, an extensive inquiry took place on a large, continuous area. The drainage, for example, of the Kruiningen polder, area 1500 hectares, is based on an examination of permeability, at which it has been tried at the same time to co-ordinate the layers occurring in the profile and the permeability of the profile.

The apparatus constructed by Prof. Visser will be de-

monstrated. The principle of the determination of permeability according to the bore-hole method, is based on measuring the rising-speed of the groundwater in a hole, bored till below the phreatic plane. According as the rising-speed is greater, the permeability is also greater.

What is measured is: the average permeability of the complex of layers between the phreatic plane and the bottom of the bore-hole for a water-current in almost horizontal direction. By boring several holes to different depths, the permeability of the various layers of the soil may be determined.

Under normal circumstances and dependent on the soil profile, one to three spots per hectare are selected, where a fourfold determination is carried out.

The length of time required for a single measuring, inclusive of putting up the apparatus and working out the data, is fifteen minutes on an average. One man can attend two apparatuses at a time. The holes are bored one or two days beforehand.

With the aid of monograms, the permeability and, if required, the drain-distance, may be calculated directly in the field from the data.

After this demonstration we shall drive, via Zoutelande to West-Kappelle, through an area that has stood under the influence of the dike-breach near West-Kappelle. A large inundation-creek has been formed.

3. *West-Kappelle*

Inspection of the new sea-dike, which has been constructed a little more inland than the old, destroyed one.

From West-Kappelle to Domburg along the foot of the dunes.

Lunch at Domburg.

After lunch we shall drive via Oost-Kappelle and Serooskerke to the Rijkebuurtweg, north-west of Veere, where experimental fields have been laid out for the restoration of the sea-clay soils that were inundated by sea-water.

4. *Experimental fields S.M.I. Serooskerke*

During the inundation with sea-water many Ca-ions were exchanged against Na, Mg, and K-ions. The maximum Na-complement is 40 % of the absorption complex.

After two or three winters the soil moisture is normal again, the soil is, however, still very rich in Na, consequently impermeable and when drying up it becomes very hard.

Restoration with gypsum ($\text{CaSO}_4 \cdot 2 \text{ aq}$), placed at the disposal by the Government. Required quantities of gypsum, determined on the basis of experiments on various soil types. Experiments have also been made with sulphur (S), chloride of lime (CaCl_2), and lime. Great differences in structure make their appearance with S and $\text{CaSO}_4 \cdot 2 \text{ aq}$. The solubility of

Fig. 19 Trial plot scheme

17	sulphur	2 tons	gypsum	5 tons	34
16	lime	$3\frac{1}{2}$ tons	0		33
15	CaCl_2	6 tons	gypsum	10 tons	32
14	preparation from Soc. de l'Humus 2 l.		lime	$1\frac{3}{4}$ tons	31
13	sulphur	1 ton	CaCl_2	2 tons	30
12		0		0	29
11	lime	$5\frac{1}{4}$ tons	sulphur	3 tons	28
10	CaCl_2	4 tons	preparation from Soc. de l'Humus 1 l.		27
9	gypsum	15 tons	lime	$3\frac{1}{2}$ tons	26
8	sulphur	2 tons	CaCl_2	6 tons	25
7		0	gypsum	5 tons	24
6	CaCl_2	2 tons	lime	$5\frac{1}{4}$ tons	23
5	preparation from Soc. de l'Humus 1 l.			0	22
4	gypsum	10 tons	sulphur	1 tons	21
3		0	CaCl_2	4 tons	20
2	lime	$1\frac{3}{4}$ tons	preparation from Soc. de l'Humus 2 l.		19
1	sulphur	3 tons	gypsum	15 tons	18

CaCl_2 is too great in consequence of which this is partly washed out.

We subjoin the trial plot scheme (fig. 19) with the various means applied (quantities per hectare).

On the basis of a few small fields that have been treated and others that have not been treated (8×6.25 m), the structure-improving action of the various substances will be shown.

After this demonstration we shall drive *back to Middelburg via Veere*. Near Veere a second inroad-area with creek-formation just as was the case near West-Kappelle.

If we can afford the time, a few historical buildings will be viewed in the remarkable little Zealand town of Veere.

Then from Veere to Middelburg and afterwards back by train to Breda.

Revised programme of the excursion Breda VIII (Walcheren)

Because of the development of the reconstruction work, the plan of the excursion has been changed a little. The reallotment is in full swing at different points along the route.

1. *Noordbeek*, S.W. of Middelburg, very similar to the description in the printed programme sub. 1, creek ridge soil and pool soil.

2. *Noordbeek*. Demonstration of the apparatus of Hooghoudt and Visser to measure the permeability of the subsoil. See printed programme no. 2.

Lunch at Vlissingen.

3. *Experimental Fields*, showing the beneficial action of gypsum on sodium soils near Zoutelande. Scheme of the experiment will be distributed.

4. *Westkapelle*. (Is demonstration 3 of the printed programme).

If time allows, visit of Veere.

EXCURSION BREDA VIII – WESTLAND

Subject:

Various Westland soils in connection with intensive horticulture (grapes, tomatoes, peaches, vegetables).

References:

EDELMAN, C. H. (1950) — Soils of the Netherlands, Amsterdam.

LIERE, W. J. VAN (1948) — Soil conditions in the Westland, The Hague.

Various contributions in: „Boor & Spade” (”Auger & Spade”), Utrecht, Vol. I, 1948; Vol. II, 1948; Vol. III, 1949.

Appendixes:

Map 12, Reconnaissance Soil map of the Westland.

Map 13, Land-classification map of the Westland.

Route-map (fig. 20).

Excursion under the guidance of: L. H. J. VAN DER KLOES, W. J. VAN LIERE, H. C. DE ROO and C. P. SCHEEPERS.

Start: by bus from Breda at 8.30 a.m.

Lunch at Poeldijk.

Arrival at Breda at abt. 5 p.m.

EXCURSION PROGRAMME

As to a description of the soil condition, the reader is referred to: Edelman, C. H. (1950), Soils of the Netherlands, chapter VIII.

Route and excursion points:

Start from Breda via Moerdijk, Dordrecht, Rotterdam, Vlaardingen to Maassluis.

1. *Between Maassluis and Maasland*

General view of the shrinkage of the peaty soil during the last few centuries. The water-level in the „Vliet” lies 2 m above the land.

View of the glass-house complexes of the Westland.

From Maassluis along the highway to Westerlee, along

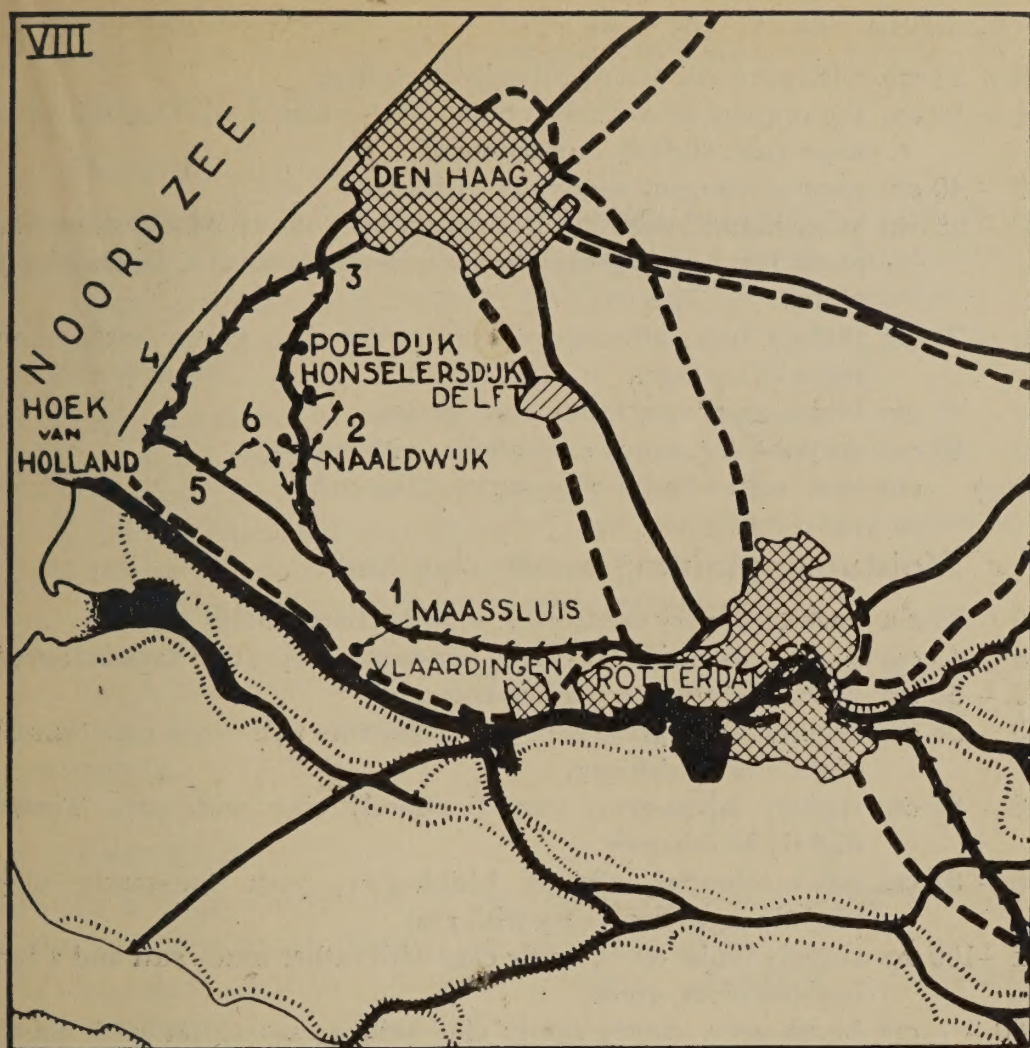


Fig. 20. Route-map

the Middelbroekweg to Honselersdijk and along Mariëndijk to Kwintsheul.

2. Honselersdijk and Kwintsheul

Culture of grapes and peaches on wet and moisture-containing sandy clay soils and on shipped-up soils.

a. Wet sandy clay soil

- 0 – 18 cm dark grey, slightly sandy clay. Very small quantity of coarse sand
- 18 – 28 cm dark, slightly dun-coloured, sandy clay, mixed with a quantity of subsoil
- 28 – 33 cm a slightly ashen tinge, slightly bluish grey, sandy clay, greasy with rust and shell-grit
- 33 – 40 cm dun-coloured, slightly bluish-grey, sandy clay, greasy and rusty.
- 40 – 60 cm bluish-grey, slightly sandy clay, greasy and rusty
- 60 – 70 cm bluish-grey, slightly sandy clay, sticky, much rust and bog-ore pipes
- 70 – 92 cm greyish-blue clay with many fine bog-ore pipes and rust
- 92 + cm blue clay with green reduction

b. Moist sandy clay soil

- 0 – 22 cm dark grey sandy clay mixed with subsoil
- 22 – 30 cm slight quantity of dark grey sandy clay mixed with top soil with some rust; slightly dun-coloured
- 30 – 40 cm some ashen-grey sandy clay with rust
- 40 – 60 cm ashen-tinted, slightly bluish-grey, very sandy clay with rather much rust and bog-ore pipes. Some sea-shells at a depth of abt 50 cm
- 60 – 75 cm slightly blue, ashen-grey, very sandy clay, greasy with much rust and shell-grit
- 75 – 82 cm bluish-grey, very sandy clay, greasy
- 82 – 88 cm greyish-blue, sandy clay, sticky, with rust
- 88 + cm blue, rather heavy clay, sticky, little rust

c. Moisture-containing sandy clay soil

- 0 – 25 cm dark grey, very sandy clay, slightly coarse-sandy
- 25 – 43 cm slightly brownish-grey, very fine-sandy clay rather dark-coloured
- 43 – 50 cm ditto, slightly more ashen-coloured
- 50 – 56 cm slightly ashen-grey, very fine-sandy clay with some rust. Tinted slightly brownish-grey
- 56 – 66 cm slightly ashen-grey, very fine-sandy clay with rust. Tinted slightly bluish-grey
- 66 – 82 cm ashen-coloured, slightly bluish-grey, very fine-sandy clay Slightly greasy and silty with rust
- 82 – 100 cm slightly bluish-grey, sandy clay with rather much rust and a few bog-ore pipes, greasy
- 100+ cm bluish-grey, clayey sandy clay soil, greasy to fat with much rust, bog-ore pipes and some shells

d. Shipped-up soil

- 0 – 30 cm dark, slightly brownish-grey, coarse-sandy sandy clay soil
- 30 – 55 cm dark grey, coarse-sandy, sandy clay soil
- 55 – 63 cm ditto, slightly ashen-grey
- 63 – 68 cm ditto, slightly more ashen-grey, mixed with less dark subsoil, poorer in humus
- 68 – 72 cm grey, slightly dun-coloured, coarse-sandy, sandy clay soil, slightly greasy
- 72 – 78 cm grey, slightly ashen-blue coloured coarse-sandy clay, greasy
- 78 – 82 cm ditto, less coarse-sandy, some rust
- 82 + cm bluish-grey, slightly ashen-grey clay, with some shells; in crevices and root-channels some coarse-textured sand

e. Wet sandy clay soil

- 0 – 20 cm dark grey, slightly sandy clay mixed with coarse-textured sand and organic material (mould etc.)
- 20 – 43 cm dark, slightly ashen-grey clay mixed with subsoil, slightly greasy, some rust
- 43 – 54 cm ashen-grey, slightly sandy clay with rust, greasy to fat. Some reduction around the grape-roots

- 54 - 63 cm slightly bluish-grey, slightly sandy clay with rather much rust
 63 - 75 cm slightly bluish-grey clay with much rust, fat
 75 + cm bluish-grey, fat, rather dark

3. *The Hague - Loosduinen*

The intensive horticulture is being superseded by the extension of the town of The Hague. Very fertil dune-sand soils, upon which an intensive cultivation of vegetables.

Black dune-sand soil

- 0 - 32 cm very dark grey sand
 32 - 37 cm ditto, with some organic rets
 37 - 44 cm dark, slightly ashen-grey sand
 44 - 51 cm very dark, slightly ashen-grey sand with slightly blue reduction
 51 - 62 cm very dark, slightly blue-ashen-grey sand
 62 + cm whitish-grey, rather coarse-textured sand

From Loosduinen to *Poeldijk*, where lunch will be partaken of. After lunch, from *Poeldijk* via *Monster* to *Arendsduin*.

4. *Arendsduin*

From a high dune-top of the young dunes a general view of the horticultural district of the Westland.

From *Arendsduin* to the garden „*Boshek*“, between 's-Gravenzande and *Hook of Holland*.

5. *Garden „Boshek”*

Horticultural undertaking on pure dune-sand.

Dune-sand soil

- 0 - 28 cm slightly grey sand with some shell-grit (dune-sand)
 28 - 50 cm ditto, slightly darker
 50 - 65 cm slightly ashen-grey sand with shell-grit
 65 - 80 cm ditto. Some blue reduction colours around the grape-roots
 80 - 95 cm ditto. Blue reduction around the grape-roots
 95 - 105 cm very many shells with grey, rather coarse sand
 105 + cm bluish-grey, rather coarse sand

The quantities of artificial fertilizers used on these soils are very large. For example, for two successive cultures under glass of cauliflower and tomatoes, the following total quantities are given together: 200 plus 150 is 350 kilos of pure N, 200 kilos of P_2O_5 and 250 plus 175 is 425 kilos of K_2O per hectare.

From „*Boshek*” to the garden of the Experiment Station

for the Cultivation of Vegetables and Fruit under glass at Naaldwijk.

6. *Experiment Station for the Cultivation of Vegetables and Fruit under Glass*

Inspection of the undertaking and of the horticultural products put in readiness for the home and foreign markets.

Via Maassluis, Vlaardingen, Rotterdam back to Breda.

EXCURSION BREDA IX BRABANT SANDY SOILS

Subject:

Agriculture and horticulture on wet and dry sandy soils.

References:

EDELMAN, C. H. (1950) — Soils of the Netherlands, Amsterdam.

DIEPEN, D. VAN — Report of the Soil Survey of Breda (in course of preparation).

HAANS, J. C. F. M. (1948) — A Soil Survey of the Surroundings of Bergen op Zoom (has not yet appeared in print).

Various articles in „Boor & Spade” (”Auger & Spade”) Utrecht, 1948, 1949.

Appendixes:

Map 14, Simplified Soil-map of Bergen op Zoom.

Map 15, Land-classification table of horticultural soils.

Map 16, Simplified Soil-map of Breda.

Route-maps (fig. 21a en 21b).

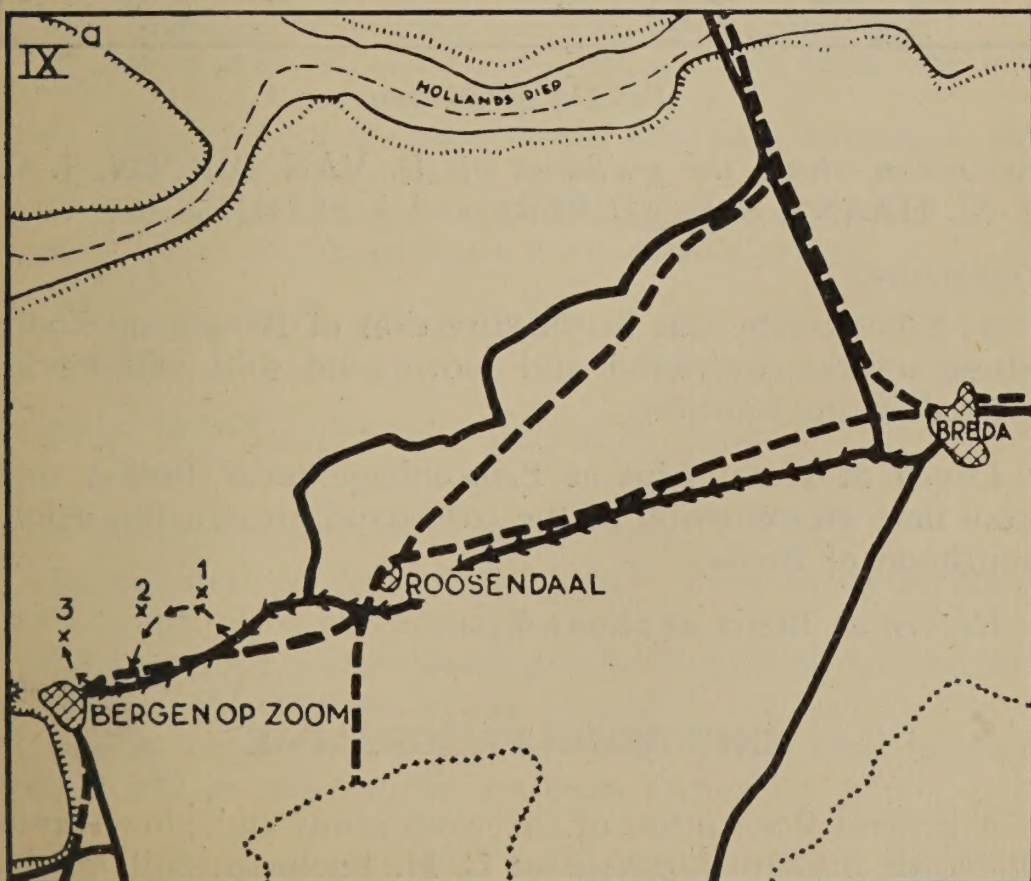


Fig. 21a. Route-map

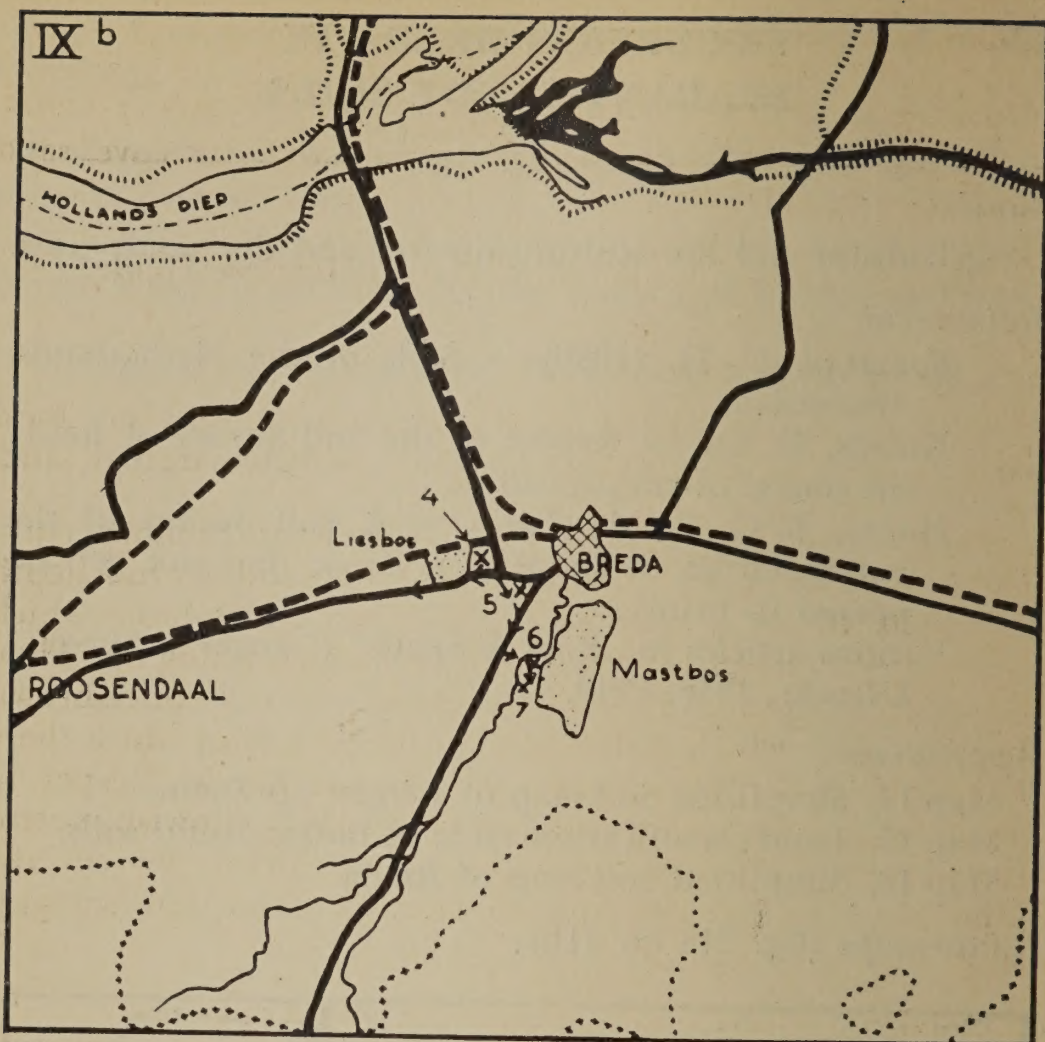


Fig. 21b. Route-map

Excursion under the guidance of: D. VAN DIEPEN, J. C. F. M. HAANS, S. F. KUIPERS and J. SCHIJEN.

Departure:

At 8.30 a.m. by bus in the direction of Bergen op Zoom where several cover-sand and blown-sand soils will be inspected in the morning.

Lunch at Hotel Lips at Princenhage (near Breda) and from here an excursion in the cover-sand area in the neighbourhood of Breda.

Return at Breda at about 5 p.m.

EXCURSION-PROGRAMME

A general description of the cover-sands and blown-sands of North Brabant is given in: C. H. Edelman: Soils of the Netherlands, 1950, chapter III.

Route and Excursion-points.

Morning excursion in the neighbourhood of Bergen op Zoom.

Agriculture and horticulture on wet and dry cover-sand and blown-sand soils.

Departure from Breda via Wouw to Heerlese Heide.

1. Heerlese Heide.

Young reclamation of medium-high heath-soil on local cover-sand. Example of a reclamation of sub-marginal land.

Profile: Below a greyish-black, somewhat humous cultivation layer of about 20 cm in depth, there follows to a depth of about 40 cm a grey to blackish-grey heath-layer which contains very much bleached sand and which is dug up. Then comes to a depth of 55 or 60 cm the B. layer, a coffee-brown bog-ore layer, which is firm and at the bottom of which there are hard, dark brown, small infiltration bands. Deeper to about 90 cm the colour of the sand becomes yellowish-brown; blackish-brown fibres are found in it. Below 90 cm the sand has a yellowish-white colour. At about 150 cm gley spots occur.

- 0 – 20 cm slightly humous, greyish-black layer of cultivation
- 20–±40 cm grey to blackish-grey heath-layer containing very much bleached sand; dug up
- ±40–±55 cm coffee-brown bog-ore layer, firm, hard, dark brown, small infiltration-bands at the bottom
- 55 – 90 cm yellowish-brown sand with blackish-brown fibres
- 90 + cm yellowish-white sand; at abt. 150 cm gley spots

The sand of the whole profile is of a moderately coarse texture.

From Heerlese Heide to Bergen op Zoom.

2. Sand-pit east of Bergen op Zoom.

Blown sand on cover sand (locally cover sand) separated by a beautiful fossile vegetation profile.

Medium-high to low heath-profile, the latter covered with peat from the Atlanticum and younger.

Fossile heath profile covered up by blown sand in which practically no soil profile has been formed.

From the sand-pit to the horticultural soils in the neighbourhood of Bergen op Zoom.

3. *Bergen op Zoom*, old horticultural soils.

Basin-shaped blown-sand area in which three profiles with different water-condition and the horticulture fitting in with it, will be demonstrated.

a. *Profile*: Very moist, humous, old garden-ground (basin-shaped part in blown-sand landscape).

The top soil is very humous and black. Right up to the ploughed layer small rust-stains are found. The sand is of a moderately coarse texture. The black cover has a depth of about 40 to 50 cm. Below this we mostly come across an old vegetation profile consisting of a small, sticky-compact layer, a few centimetres in depth, a thin, small bleached layer, and then a bog-ore-like layer of a grimy-brown colour. The deeper subsoil is often somewhat loamy.

- 45 cm black, highly humous top soil, small rust spots are sometimes present
- 45 – 48 cm sticky, black, smeary, little layer
- 48 – 53 cm bleached, little, bleached-sand-like layer
- 53 – 75 cm grimy-brown coloured sand, slightly bog-ore-like
- 75 + cm ashen-yellow, finer, somewhat loamy sand

Soil type fit for green-leafy vegetables, such as: lettuce, endive and spinach, turnip-rooted celery, leek, carrots, red beet-roots.

b. *Profile*: Moist, humous, old garden-ground.

This profile lies a little higher than the preceding one. The top-soil is humous, of a black to brownish black colour, about 35 to 45 cm in depth. Here, too, an old vegetation profile often occurs beneath the black cover. It consists of a slightly bleached brownish-purple A-horizon, below which a brown B-horizon follows.

- | | | |
|--|---|---------------------------|
| 0 – 35 cm black cultivation layer | } | moderately
coarse-sand |
| 35 – 40 cm grimy-yellow coloured sand | | |
| 40 – 42 cm black, greasy-dirty, little layer | | |
| 42 – 60 cm brownish-purple A-layer | | |
| 60 – 75 cm B-layer, dark brown to blackish-brown, not firm | | |
| 75 – 85 cm B-layer, light brown, not firm | | |
| 90 – 100 cm sandy loam | | |

Soil type fit for: strawberries, red beet-roots, peas, beans, large and small fruit etc. Many cultures are possible. Is earlier than the preceding type.

c. *Profile*: Dry blown-sand soil.

This profile lies still higher than the two preceding ones.

The top soil is poor in humus, blackish-brown in colour. Downwards the sand becomes yellow: in the subsoil often occurs a podzol profile.

- 0 – 40 cm blackish-brown top soil, deficient in humus
- 40 – 70 cm yellow sand
- 70 – 75 cm black sticky layer
- 80 – 110 cm grey, bleached-sandy layer
- 110+ cm brown bog-ore soil

A soil of this kind may still be used for asparagus.

From Bergen op Zoom via Wouw back to Princenhage (near Breda). Along the road partly flourishing agriculture on loamy cover sands and poor agriculture on dry cover sands and blown sands.

Lunch at Princenhage.

Afternoon excursion in the neighbourhood of Breda.

Agriculture and horticulture on good cover-sand soils.

To Liesboslaan near Princenhage.

4. *Liesboslaan.*

Good horticultural soils on loamy cover sand.

a. Moist, old, arable woodland soil, fit for early cultures and glass cultures.

Profile

- 0 – 30 cm ploughed layer, dark brown, humous
- 30 – 40 cm older layer of cultivation, dark brown, firmer
- 40 – 50 cm brown wood horizon
- 50 – 65 cm ditto, tinted grey with gley at the bottom
- 65 – 85 cm brown wood horizon with gley
- 85 – 100 cm sandy loam horizon, rich in silt

b. Very moist, old arable woodland soil, fit for summer vegetables.

Profile

- 0 – 25 cm ploughed layer, blackish-brown, humous
- 25 – 35 cm older layer of cultivation, firmer, still blackish-brown humous
- 35 – 45 cm dark brown wood horizon with gley
- 45 – 65 cm wood horizon dingy blackish-brown
- 65 – 85 cm dingy, dark grey slightly brown tinted wood horizon in loamy, fine sand that is richer in silt

From Liesboslaan to Effense brug near Princenhage.

5. *Ritse straat.*

Old, black loamy brook-grassland soil, manured organically from of old.

Profile

- 0-±30 cm black humus, containing silt
- 30- 50 cm dingy brownish-grey loamy sand, humous, gley
- 50-±70 cm dark dingy-grey sandy loam
- 70-±100cm peat, dark brown

6. *Effense brug.*

Loamy grassland soils in a brook valley.

Old, brown brook-grassland soil, not manured organically from of old.

Profile

- 0 - 5 cm dark brown sod
- 5 - 20 cm dark brownish-grey rust-spotted loamy sand (gley)
- 20 - 33 cm lighter coloured dingy-grey sandy loam, still containing humus
rust-spotted to a degree
- 33 - 45 cm grey light-sandy loam, less rust-colouring
- 45-100 cm bluish-grey sandy loam

7. *Overase weg.*

Old black crop land soil on pure cover sand. Fit for very early horticultural crops and normal farming-crops.

Profile

- 0- 35 cm black humous sand, layer of cultivation
- 35- 45 cm blackish-brown humous sand, discoloured wood horizon, older
layer of cultivaton
- 45- 65 cm humous wood layer tinted brownish-grey
- 65-±70 cm brownish-grey less humous transitional horizon of the wood
profile
- 70- 100 cm greyish-white sand with gley

From Overa back to Breda.

DUTCH COINS AND BANKNOTES

f	0.01	—	1 cent (coin: copper or zinc).
f	0.05	—	5 cents; penny (coin: copper, zinc or nickel).
f	0.10	—	10 cents; dubbeltje — twopenny bit (coin: nickel, zinc or silver).
f	0.25	—	25 cents; kwartje — fivepenny bit — fourth part of a guilder (coin: zinc, nickel or silver).
f	1.00	—	1 gulden — guilder — 100 cents (silver-coin or banknote).
f	2.50	—	2.5 guilders — rixsdollar (silver-coin or banknote).
f	10.00	—	10 guilders (banknote).
f	20.00	—	20 guilders (banknote).
f	50.00	—	50 guilders (banknote).
f	100.00	—	100 guilders (banknote).

POSTAL RATES

	<i>For abroad</i>	<i>Belgium and Luxemburg</i>
Letters 0—20 grammes	f 0.20	f 0.10
per 20 „ more	f 0.12	f 0.10
Postcards	f 0.12	f 0.06

AIR-MAIL

To nearly all European countries, letters and postcards are despatched without the imposition of an air-fee.

Air-fee in addition to ordinary postage for a few destinations:

Per 5 grammes

Argentina	40 cents
Belgian Congo	35 „
Brazil	40 „
India & Pakistan	35 „
Canada	30 „
Ceylon	35 „
China	35 „
Columbia	40 „
Egypt	5 „
Malaya	40 „
Thailand - Vietnam	40 „
Union of South Africa	35 „
Venezuela	40 „
United States of America	30 „

For *postal parcels* etc. apply for information to stamp-window at post-office.

Letters for abroad, weighing upwards of 20 grammes must not be dropt into the pillar-box, but should be presented *open* for despatch at the post-office.

CONVERSION TABLE

1 cm	0.3937 inch
1 m = 100 cm	3.28 feet = 1.094 yard
1 km = 1000 m	0.621 mile
1 inch	0.0254 m
1 foot (12 inches)	0.305 m
1 yard (3 feet)	0.914 m
1 chain	20 m
1 mile	1609.3 m
1 ha = 100 × 100 m	2.47 acres
1 acre = 10 sq chains	0.405 ha
1 gallon (Imperial)	4.55 l = 1.2 Am. gallons
1 bushel (Imperial)	36.35 l = 1.032 Am. bushels
1 kg	2.204 lbs
1 lb (pound avoirdupois)	0.453 kg
1 cwt (hundred weight)	50.8 kg = 112 lbs
1 (metric) quintal (q)	100 kg = 220.5 lbs
1 doppelzenter (dz)	100 kg = 220.5 lbs
1 short ton	2000 lbs = 907 kg
1 metric ton	2205 lbs = 1000 kg
1 long ton	2240 lbs = 1016 kg
1 bushel per acre	0.9 hl per ha
1 lb per acre	1.12 kg per ha
1 cwt per acre	125.6 kg per ha
1 q per ha	89.2 lbs per acre

Scale of soilmaps

1 : 5000	approximately 12 inches to a mile
1 : 10.000	6 " " " "
1 : 25.000	2.5 " " " "
1 : 64.000	1 " " " "

(4)
congress

**FOURTH INTERNATIONAL CONGRESS
OF SOIL SCIENCE
AMSTERDAM
1950**

**POST-CONGRESS EXCURSIONS
THROUGH THE NETHERLANDS
AUGUST 2nd-12th**

**LIST
OF PARTICIPANTS
IN THE EXCURSIONS**



GROUP A

(Excursions Groningen, Wageningen, Breda)

Meetingplace: the Dam in Amsterdam, August 2nd at 1.45 p.m.

Participants in the excursions: Groningen, Wageningen, Breda and through Belgium (August 2-19th)

232	Albrecht, W. A.	Columbia, U.S.A.
233	Albrecht, Mrs W. A.	Columbia, U.S.A.
294	Ableiter, J. K.	Beltsville, U.S.A.
295	Ableiter, Mrs J. K.	Beltsville, U.S.A.
196	Atkinson, H. J.	Ottawa, Canada
264	Avery, B. W.	Bristol, Great Britain
257	Ayres, A. S.	Honolulu, U.S.A.
258	Ayres, Mrs A. S.	Honolulu, U.S.A.
336	Bach, R.	Zürich, Switzerland
259	Bonnet, J. A.	Puerto Rico, U.S.A.
532	Bradfield,	Ithaca, U.S.A.
533	Bradfield, Mrs	Ithaca, U.S.A.
204	Brind, W. D.	Harpenden, Great Britain
424	Campbell, D. A.	Wellington, New Zealand
425	Campbell, Mrs D. A.	Wellington, New Zealand
409	Clark, R. E.	Ithaca, U.S.A.
506	Codinho Gouveia, D. H.	Lorenzo Marques, Port. East Africa
387	Cooper, H. P.	Clemson, U.S.A.
73	Deloffre, G.	La Madeleine, France
285	Demortier, G.	Gembloux, Belgium
226	Durand, J.	Algiers, France
446	Elzik, E.	Assiut, Egypt
447	Elzik, Mrs N.	Assiut, Egypt
341	Finielz, H.	Tunis, France
167	Furneaux, B. S.	Brenchley, Great Britain
322	Geus, J. G. de	Djakarta, Netherlands
147	Greene, H.	Harpenden, F.A.O.
310	Greenstreet, V. R.	Zomba, Great Britain
218	Hall, Th. D.	Johannesburg, South Africa
219	Hall, Mrs P. M.	Johannesburg, South Africa
150	Hardy, F.	Trinidad, Great Britain
200	Hockensmith, R. E.	Washington, U.S.A.
388	Ignatieff, V.	Washington, F.A.O.
133	Kellogg, Ch. E.	Beltsville, U.S.A.
134	Kellogg, Mrs Ch. E.	Beltsville, U.S.A.

515	Kirchmeijer, F.	Linz, Austria
227	King, D. W.	Harpenden, Great Britain
281	Koehler, Fr. E.	Columbia, U.S.A.
338	Lag, J.	Vollebekk, Norway
234	Leahy, A.	Ottawa, Canada
262	Letelier, E.	Aberdeen, Great Britain
413	Lincoln, R.	Reduit, Great Britain
414	Lincoln, Mrs R.	Reduit, Great Britain
247	Low, A. J.	Bracknell, Great Britain
469	Mannion, L.	Dublin, Eire
217	Martin, W. S.	Pietermaritzburg, South Africa
192	Menzel, R. G.	Madison, U.S.A.
181	Mitchell, W. A.	Harpenden, Great Britain
393	Monjardino, R. M.	Lisbao, Portugal
394	Monjardino, Madame M. M. T.	Lisbao, Portugal
335	Obenshain, S. S.	Blacksburg, U.S.A.
182	Osmond, D. A.	Harpenden, Great Britain
487	Ozuygur, M.	Ankara, Turkey
173	Parks, R. Q.	Beltsville, U.S.A.
374a	Piot (Ass. v. 374, Stenuit, D. F. E.)	Heverlee, Belgium
223	Reinau, E. H.	Lörrach, Germany
324	Richards, L. A.	Riverside, U.S.A.
325	Richards, Mrs L. A.	Riverside, U.S.A.
470	Ryan, P. F.	Wexford, Eire
401	Semb, G.	Vollebekk, Norway
123	Smith, A. M.	Edinburgh, Great Britain
374	Stenuit, D. F. E.	Heverlee, Belgium
386	Taylor, J. K.	Adelaide, Australia
416	Taylor, N. H.	Wellington, New Zealand
145	Thorp, J.	Lincoln, U.S.A.
146	Thorp, Mrs J.	Lincoln, U.S.A.
263	Timonin, M. I.	Ottawa, Canada
371	Vovk, B.	Ljubljana, Yougoslavia
468	Walsh, T.	Dublin, Eire
228	Wild, A.	Reading, Great Britain

Participants in the excursions: Groningen and Wageningen
(August 2-9th)

415	Andersson, S.	Uppsala, Sweden
396	Elgabaly, M.	Alexandria, Egypt
397	Elgabaly, Madame N.	Alexandria, Egypt
212	Gokhale, N. G.	Oxford, Great Britain

174	Hallgren, G.	Uppsala, Sweden
420	Irmak, A.	Istanbul, Turkey
168	Knoblauch, H. C.	Washington, U.S.A.
195	Krusekopf, H. H.	Columbia, U.S.A.
252	Kuile, C. H. H. ter	Ithaca, Netherlands
197	Mitchell, J.	Saskatoon, Canada
287	Rogers, W. S.	Maidstone, Great Britain.
514	Tanner,	Zürich, Switzerland
175	Wiklander, L.	Uppsala, Sweden
235	Woodruff, Ch. M.	Columbia, U.S.A.

Participants in the excursions Groningen (August 2-5th)

370	Albareda, J. M.	Madrid, Spain
366	Alexandre, V.	Madrid, Spain
365	Alvira, T.	Madrid, Spain
439	Aslyng, H. C.	Copenhagen, Danmark
229	Barbier, G.	Versailles, France
153	Bascomb, C. L.	Alresford, Great Britain
177	Bear, F. E.	New Brunswick, U.S.A.
178	Bear, Mrs Helen J.	New Brunswick, U.S.A.
496	Boischot, P.	Versailles, France
497	Chaminade, R.	Versailles, France
430	Hasler, A.	Liebefeld-Bern, Switzerland
274	Johannisson, Bj.	Reykjavik, Iceland
498	Joret, G.	Amiens, France
116	Mantelet, C.	Troyes, France
453	Mc Allister, J. C. V.	Carrickfergus, Great Britain
333	Mehlich, A.	Raleigh, U.S.A.
534	Meyer,	Bern, Switzerland
260	Norman, A. G.	Frederick, U.S.A.
452	Riehm, H.	Augustenberg, Germany
474	Ramser, E.	Zürich, Switzerland
475	Ramser, Mrs E.	Zürich, Switzerland
489	Schachtschabel, P.	Hannover-Herrenhausen, Germany
190	Taylor, Alex J.	Howick, Natal, South Africa
191	Taylor, Mrs A. J.	Howick, Natal, South Africa
161	Tinsley, J.	Reading, Great Britain
320	Williams, R.	Aberystwyth, Great Britain

297	Klemme, A.	Columbia, U.S.A. }	August 9-12th Breda and Belgium
298	Klemme, Mrs A.	Columbia, U.S.A. }	

GROUP B

(Excursion Wageningen)

Meeting-place in front of the Central Railway station at Amsterdam,

August 2nd at 2 p.m.

Participants in the excursions Wageningen (August 2-5th)

243	Alves, J. de Almeida	Elvas, Portugal
244	Alves, Madame I. de Sousa Almeida	Elvas, Portugal
367	Burriel-Marti, F.	Madrid, Spain
408	Davies, W. Morley	London, Great Britain
358	Deckering, F.	Arnhem, Netherlands
118	Duchaufour, Ph.	Nancy, France
96	Heiningen, J. van	Amsterdam-N., Netherlands
280	Jacob, A.	Berlin-Nikolassee, Germany
438	Kubiëna, W. L.	Madrid, Spain
141	Mancini, F.	Florence, Italy
364	Munoz, C. R.	Madrid, Spain
121	Oudin, A.	Nancy, France
368	Rios, E. Guttierrez	Madrid, Spain
129	Stahlberg, Sten.	Uppsala, Sweden
130	Stahlberg, Mrs S.	Uppsala, Sweden

GROUP C

(Excursions Breda, Groningen, Wageningen)

Meeting-place in front of the Central Railway station at Amsterdam,
August 2nd at 2.30 p.m.

Participants in the excursions: Breda, Groningen and Wageningen (August 2-12th)

351	Aaltonen, V. T.	Helsinki, Finland
300	Archibald, E. S.	Ottawa, Canada
230	Arnold, P. W.	Cambridge, Great Britain
491	Aubert, G.	Paris, France
461	Bryssine, G.	Rabat, Maroc, France
423	Crowther, E. M.	Harpenden, Great Britain
127	Deuel, H.	Zürich, Switzerland
249	Dougall, H. W.	Njal via Mano, Sierra Leone, Great Britain
119	Ferrière, Ph. J. J. Franc de	Mulhouse, France
120	Ferrière, Madame Franc de	Mulhouse, France
305	Focan, A.	Bruxelles, Belgium
75	Frei, E.	Zürich, Switzerland
76	Frei, Mrs E.	Zürich, Switzerland
431	Geering, J.	Zürich-Oerlikon, Switzerland
437	Grande Covian, R.	Sevilla, Spain
221	Greenwood, M.	Woodford, Great Britain
222	Greenwood, Mrs M.	Woodford, Great Britain
460	Grillot, G.	Rabat, Maroc, France
224	Hendricks, St. B.	Beltsville, U.S.A.
269	Herriot, R. I.	Adelaide, Australia
169	Jewitt, T. N.	Wad Medani, Anglo Egyptian Sudan, Great Britain
379	Jones, G. H.	Gethin, Kenya (East Africa)
380	Jones, Mrs G. H.	Gethin, Kenya (East Africa)
307	Jurion, F.	Bruxelles, Belgium
211	Melstel, S.	Urbana, U.S.A.
477	Middleton, K. R.	Wad Medani, Sudan, Great Britain
507	Milam, F. M.	Washington, U.S.A.
508	Milam, Mrs F. M.	Washington, U.S.A.
140	Nye, P. H.	Hove, Great Britain
376	Pereira, H. C.	Ruiru, Kenya (East Africa)

68	Rappe, G.	Vassmolösa, Sweden
368	Rios, E. Gutierrez	Madrid, Spain
406	Russell, Sir E. John	Woodstock, Great Britain
407	Russell, Lady E. J.	Woodstock, Great Britain
137	Russell, E. W.	Oxford, Great Britain
448	Schroo, H.	Austerlitz (Zeist), Netherlands
277	Shawarbi, M. Y.	Giza, Egypt
472	Stalé, J.	Lausanne, Switzerland
520	Tovborg, S.	Copenhagen, Danmark
176	Vuorinen, J.	Helsinki, Finland

Participants in the excursions Breda and Groningen
(August 2-9th)

248	Cummings, R. W.	Raleigh, U.S.A.
478	Edelkoort, J.	Wageningen, Netherlands
103	Kivinen, E.	Helsinki, Finland
471	Roseau, H.	Alger, France

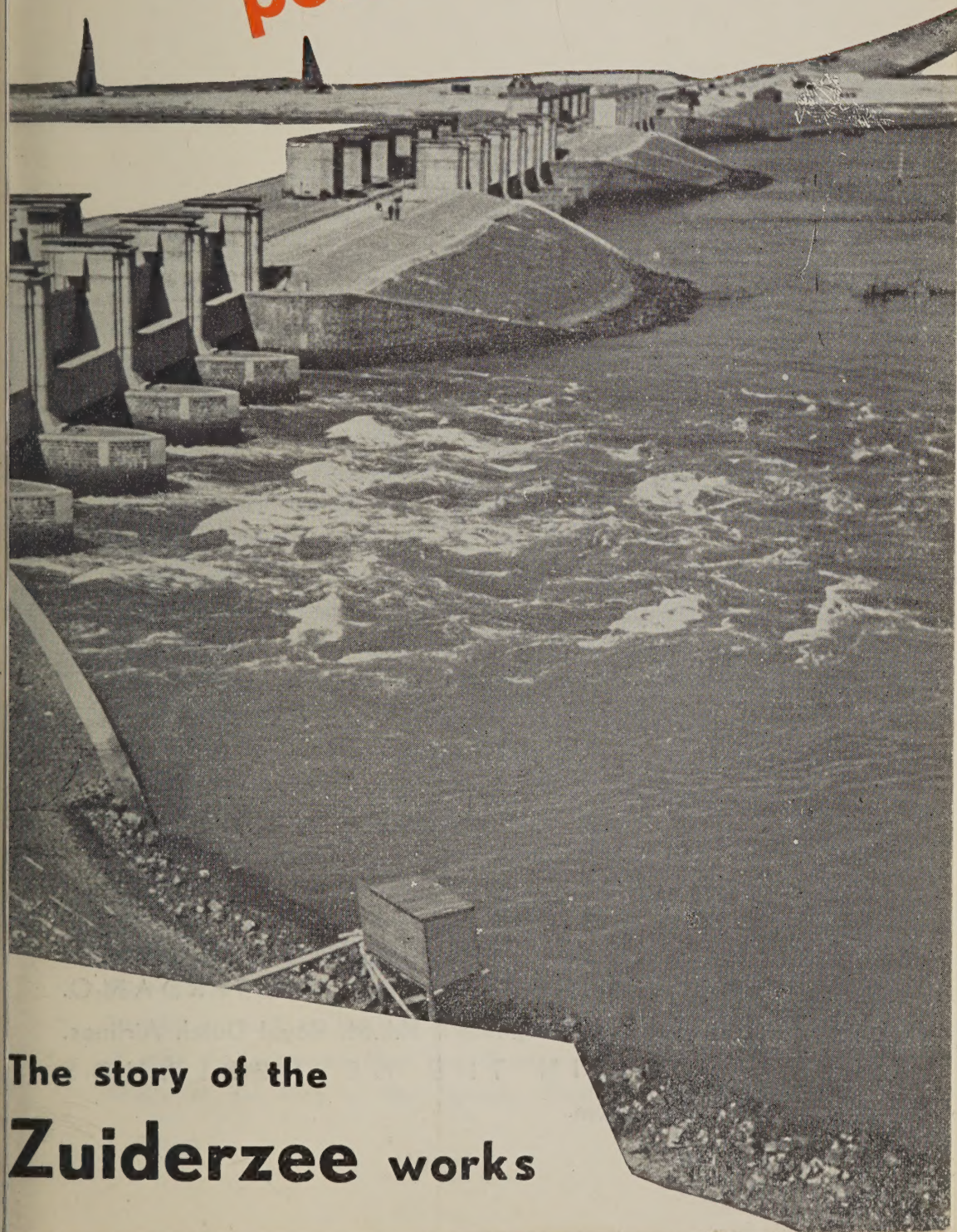
Participants in the excursions Breda (August 2-5th)

363	Abad, J. R.	Madrid, Spain
112	Bould, C.	Bristol, Great Britain
369	Hoyos, A.	Madrid, Spain
301	Penman, H. L.	Harpenden, Great Britain
302	Penman, Mrs N.	Harpenden, Great Britain
318	Schofield, R. K.	Harpenden, Great Britain
319	Schofield, Mrs T. E. S.	Harpenden, Great Britain
139	Tibbetts, Mrs E.	Berkeley, U.S.A.
362	Vilas, L.	Madrid, Spain
170	Wallace, I.	Bristol, Great Britain

July 10th, 1950

5

Fresh fields and polders new



The story of the
Zuiderzee works

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"Fresh fields and polders new"

The Story of the Zuiderzee Works.



Historians of Ancient Rome testify that a number of large lakes existed to the North of the river Rhine, such as the Flevo Lake and the Wieringen Lake and we know that the Flevo Lake was situated in the Southern part of the Zuiderzee, whereas the Wieringen Lake more or less corresponds to the Wieringermeerpolder of nowadays.

In those days the dunes must have formed an unbroken chain from the mainland of the Province of North Holland upto the present Danish coast, only interrupted here and there, at places where a river debouched into the North Sea. It is, however, impossible to give an exact description.

We do know with certainty, that the sea gradually broke through the dunes and in the course of centuries encroached upon the land once protected by them. At that time, Man was not sufficiently equipped technically to face these problems effecttively, so that he had to confine himself to the taking of primitive measures locally, which in the long run turned out to be inadequate.

By the year 1500, sufficient technical progress had been made to put an end to further encroachments of the sea, so that it may be assumed that the Zuiderzee had found its final shape at the turn of the century. There were, furthermore,

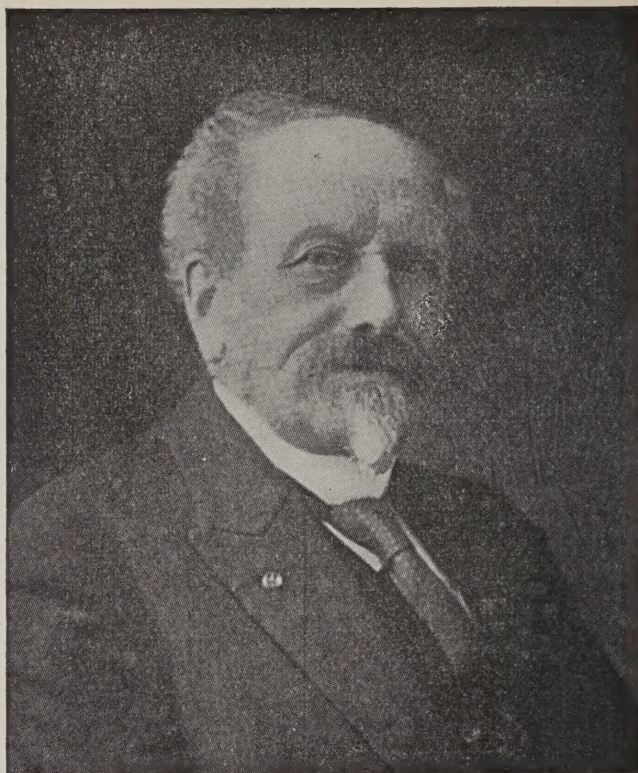


Fig. 1. Portrait of Lely.

numerous additional lakes in the Province of North Holland and in the Province of Friesland they are still in evidence. Nevertheless, it is known that even before the year 1300 Man had taken the offensive in his struggle against the water. This struggle, however, remained very unequal for the time being. In general the sea proved to be stronger, yet the technical progress made in the Netherlands, dates from that time and a great deal of thought was directed by the technicians of those days to the finding of ways and means to carry on this struggle.

After 1500 the sea made no further progress, one after the other the large lakes in the Province of North Holland were drained and very soon the idea of subduing the Zuiderzee began to occupy people's minds. However, it lasted until the middle of the 19th century before effective plans for the reclamation of the Zuiderzee took shape.

Many plans were put forward in the course of the years, and



Fig. 2

only those of Dr. Ir. C. Lely, though not as far reaching as many plans of his predecessors, appeared practicable.

After lengthy preparations the two Chambers of the States General with Dr. Lely himself as Prime Minister, passed the Bill for the closing and partial reclaiming of the Zuiderzee in the Summer of 1916. There had been disastrous inundations at the beginning of 1916, and a great deal of land had been flooded in the Province of Nord Holland. Moreover, the food shortage during the First World War was also an influencing factor.

On the 1st of May 1919, the initial technical preparations were started and in 1923 the construction of an enclosing dam was begun across the Amsteldiep, between the coast of the Province of North Holland and the island of Wieringen. This island had gained historical reputation after the First World War as the temporary home of the ex-Crown Prince of Germany.

In 1925 the dike through the Amsteldiep was completed and Wieringen ceased to be an island.

Fig. 2. Dike through the Amsteldiep.

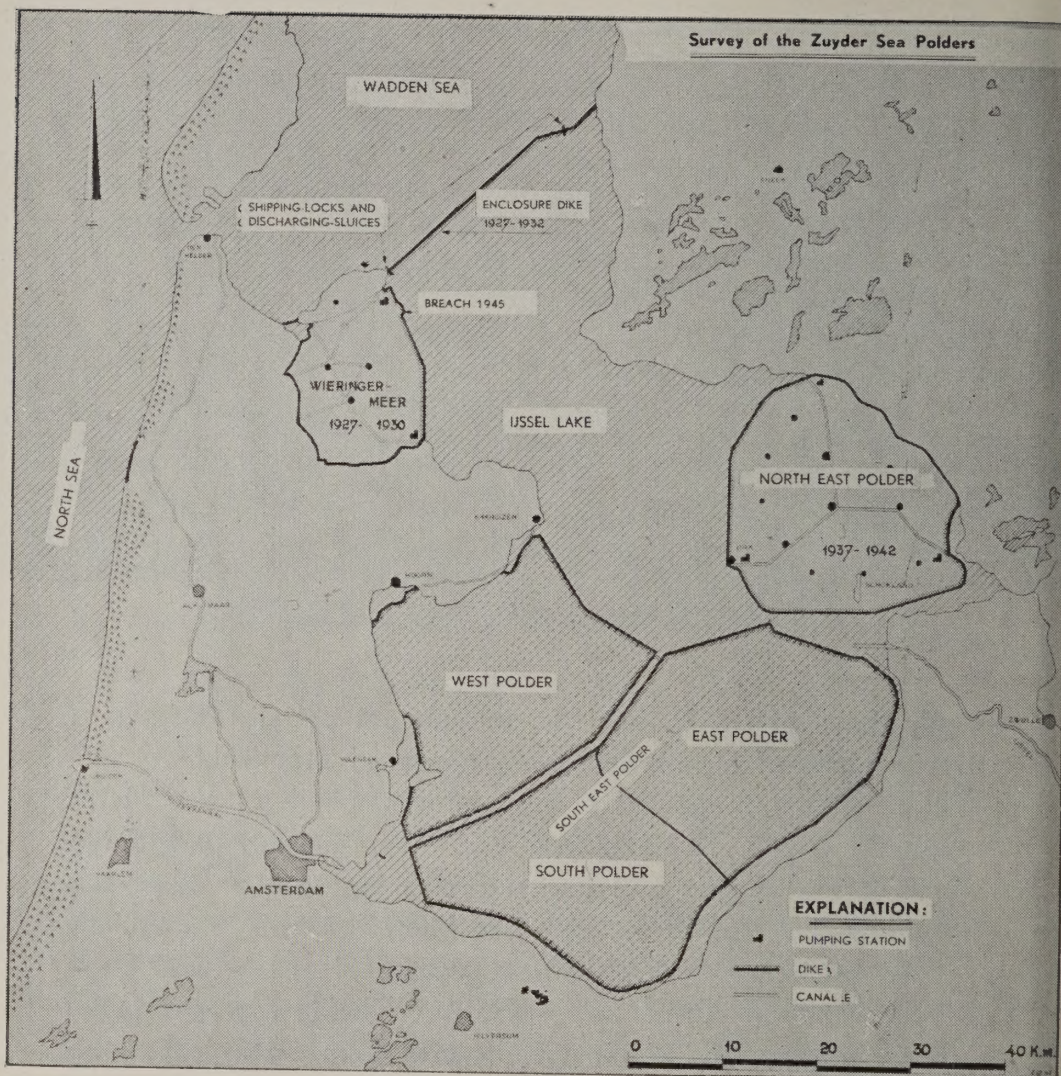


Fig. 3



Fig. 4

This dike, one-and-a half Miles in length, naturally only forms a part of the enclosing dam of the Zuiderzee.

Fig. 3. Map of the Zuiderzee works.

Accompanying map shows that this part only represented a small portion of the truly gigantic enterprise. The more important work of enclosing the Zuiderzee was to be found East of Wieringen, between this former island and the coast of the Province of Friesland, and a distance measuring about 20 Miles. The total enclosure of the Zuiderzee has a length of 27 Miles including the dike through the Amsteldiep and the length of the island of Wieringen.

The purpose of the Zuiderzee dike is to cut off the Zuiderzee from the Wadden — and the North Sea, so that a tideless fresh water lake could form itself in the enclosed part, and into which the storm-tides could not penetrate. Consequently the Zuiderzee polders are not situated on open sea and, therefore, they only required a less heavy type of dike, which meant an important saving in cost and labour.

As a further result the existing dikes of the Zuiderzee would now require hardly any maintenance and lastly the fresh water lake — the IJsselmeer — would function as a fresh water reservoir for the surrounding country in droughty summers. However, the fact had to be taken into account that the IJsel, an important branch of the Rhine, flows into the IJsselmeer and that the water from the IJsel had to leave the IJsselmeer in some or other way.

For this purpose sluices were built into the dike at two places: three sets of sluices, each containing five separate sluices were constructed near the island of Wieringen and two sets, each with five separate sluices were built on the Kornwerderzand near the coast of Friesland. To enable shipping to pass through, locks were provided, one lock in the sluice-system near Wieringen and two locks in the sluice-system on the Kornwerderzand.

These locks and batteries of sluices were constructed inde-

Fig. 5

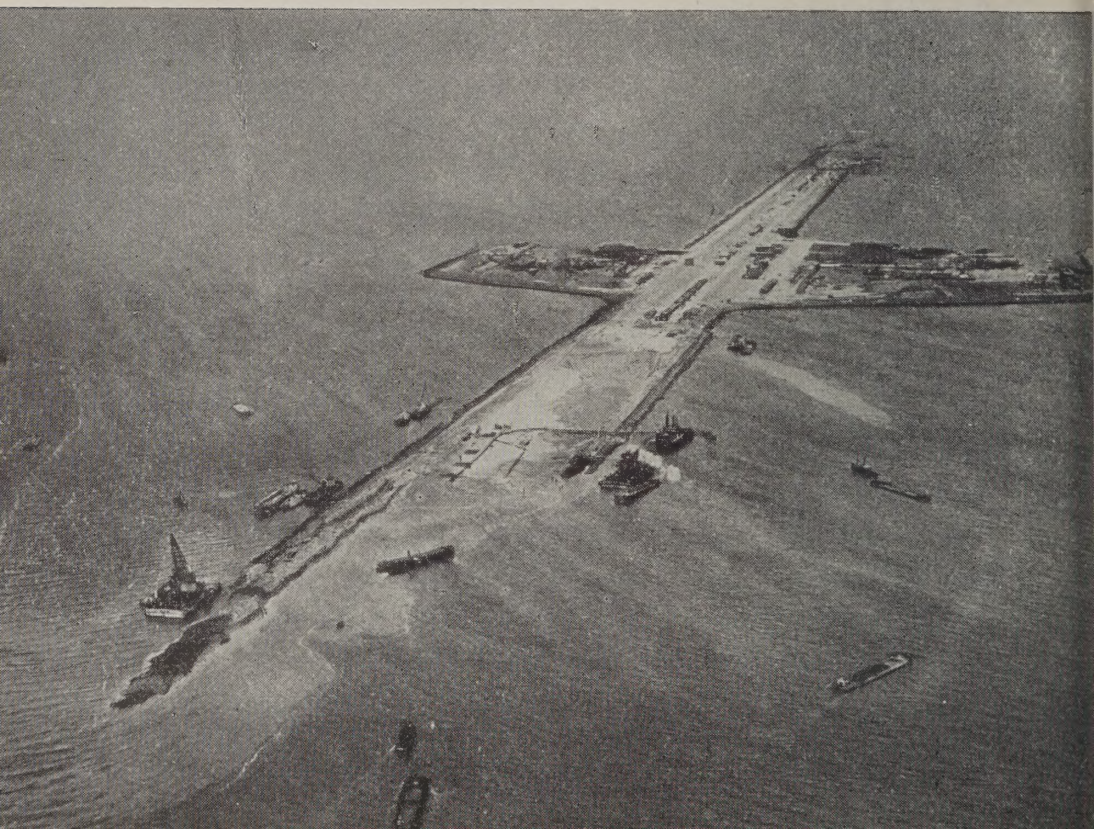




Fig. 6

pendently of the other work in progress, in separate small polders especially drained for that purpose.

Fig. 4. Shows the sluice-system near Wieringen under construction.

The lock can clearly be seen on the left and the three sets of sluices on the right.

In commencing the construction of the great enclosure dike stretching between Wieringen and Friesland, an artificial island, called Breezand, was first made. It is situated halfway between the dike and has two harbours, one on either side of the dike. Here stocks could be amassed and floating material be safely accommodated, as can be seen in fig. 5.

The building of the great enclosure dike was then started simultaneously at several places:

- a. by the construction of the building-site for the sluices near Wieringen,
- b. on either side of this site,

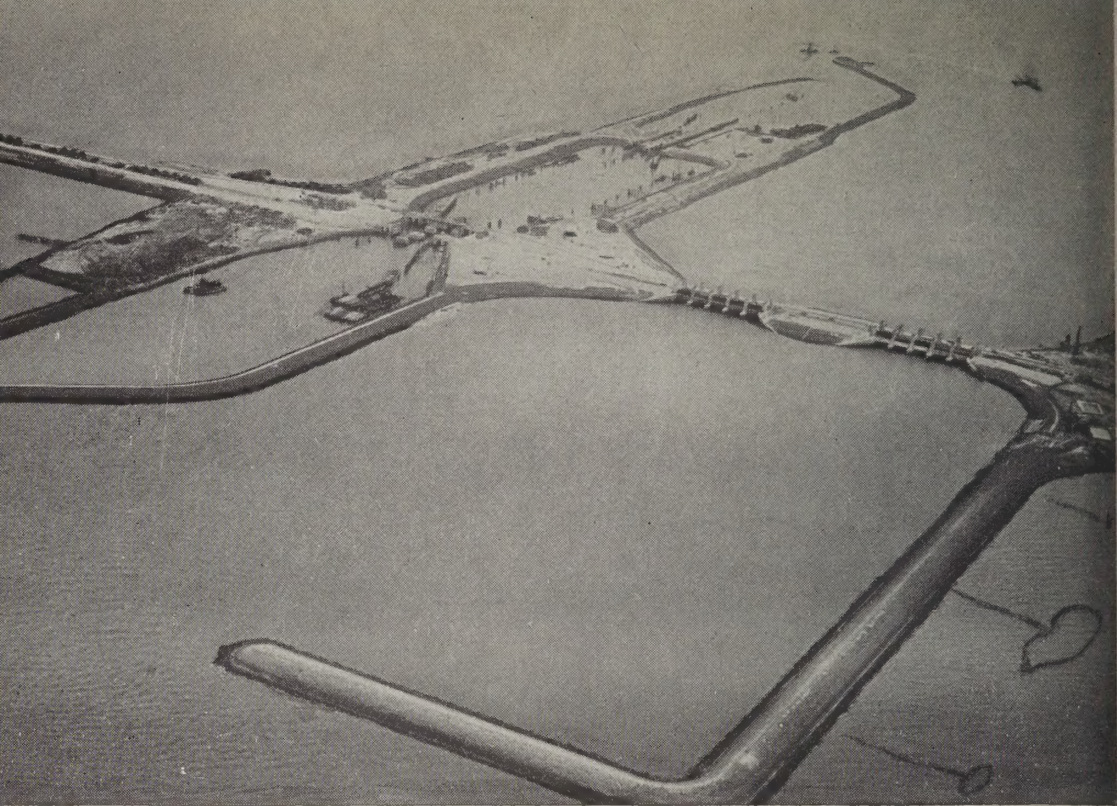


Fig. 7

- c. on either side of Breezand,
- d. on the coast of Friesland, and
- e. at either side of the building-site on Kornwerderzand.

The sea was not deep in these places and the tidal-flow, therefore, less troublesome enabling the work to proceed without any great difficulties.

Fig. 6 shows the completed sluice-system near Wieringen and fig. 7 the completed sluice-system near Kornwerderzand.

The construction of the actual great enclosure dike entailed problems of its own.

In the first place the sea was not equally deep everywhere. There were certain channels, some with considerable depth, which crossed the projected site of the enclosure dike.

As the work on the dike proceeded it was to be foreseen that the tidal-flow still existing in the Zuiderzee and which flowed in and out with each change of the tide, would scour these channels, to an ever increasing depth.

In order to prevent this process from taking on catastrophical

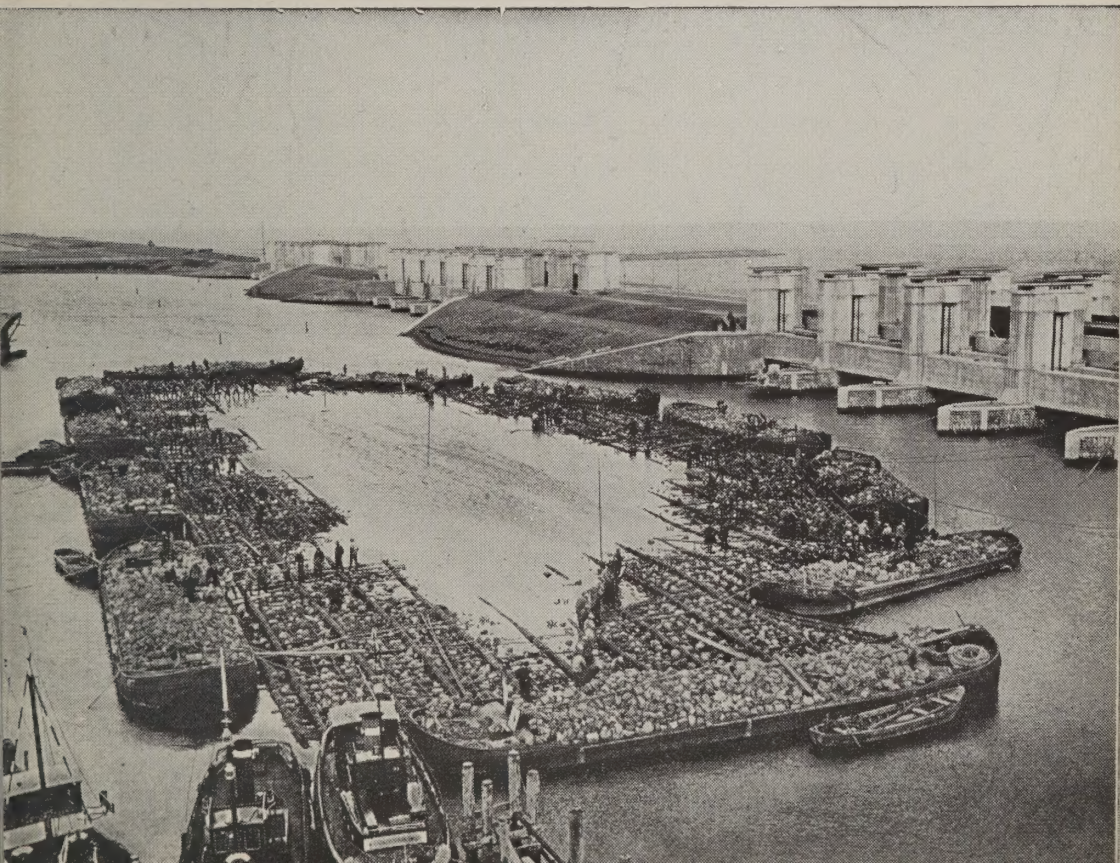
dimensions, so-called current checking dams were first built across the channels. These channels were blocked under water upto a certain height, this forced the current away from the bottom of the sea and to take its course over the current checking dam. By protecting the current checking dam with weighted willow mattresses any damage by the current was prevented.

These huge willow mattresses, weighted with stones, were sunk on the current checking dam and then covered with further quantities of stones, so that at the place in question the bottom of the sea might be said to consist practically of nothing but stones and it could now withstand the scouring motion of the currents.

Fig. 8 is a photograph showing the lowering of a protective willow mattress in front of the sluices near Wieringermeer. Here after the completion of the enclosure dike strong currents would permanently prevail.

It can clearly be seen on this photo that each sluice has two

Fig. 8



towers between which a steel gate can travel vertically up and down in order to close the sluice at high tide against the sea water and to open it at low tide to discharge the water of the IJssel Lake.

After the completion of the sluice-system, the surrounding dikes were removed, so that the sluices were in water on either side.

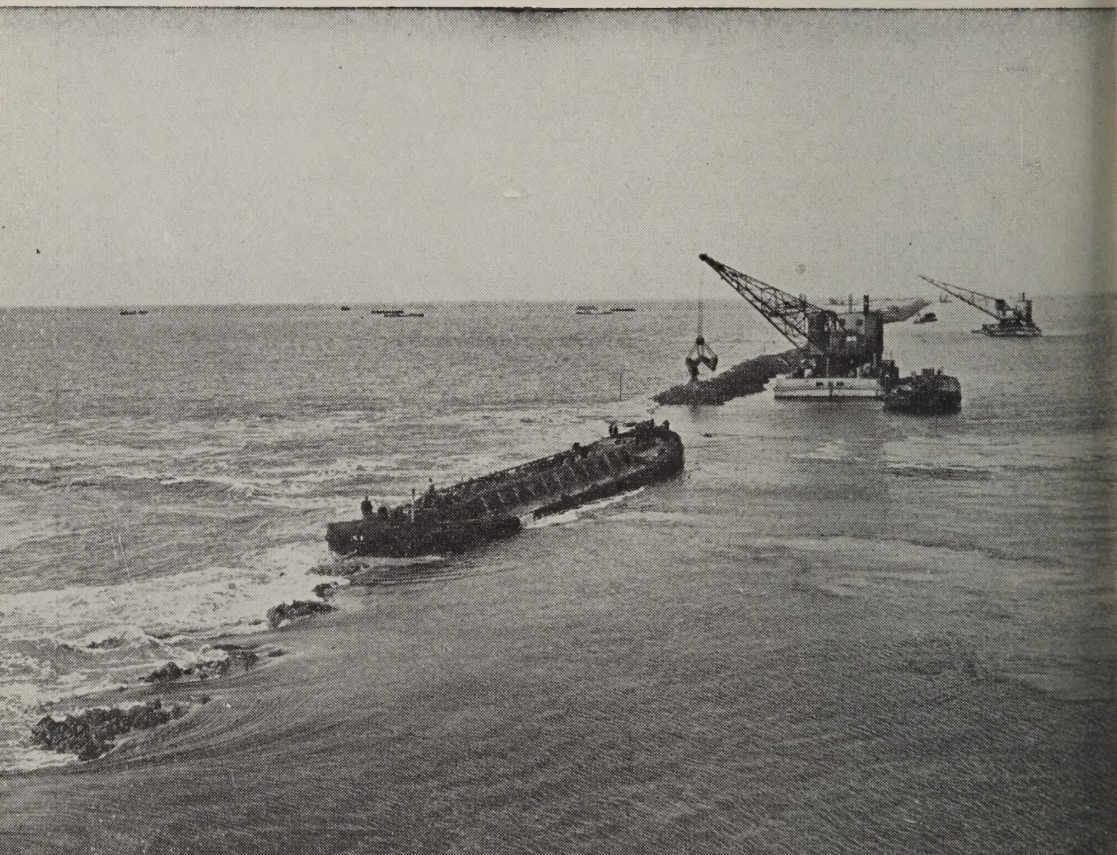
The construction of the great dike took place by first building two parallel dams of so-called boulder clay, a very heavy and tough loam, which was found in fairly large quantities at the bottom of the IJssel Lake. The space in between the dams was filled up with sand from pump dredgers.

Fig. 9 shows how the boulder clay for the dams is being discharged from hopper barges by opening the bottoms of these barges.

Fig. 10. Show pumps dredges in action filling up the space between the parallel boulder clay dams with sand.

As work on the dike progressed, the openings, left for the

Fig. 9



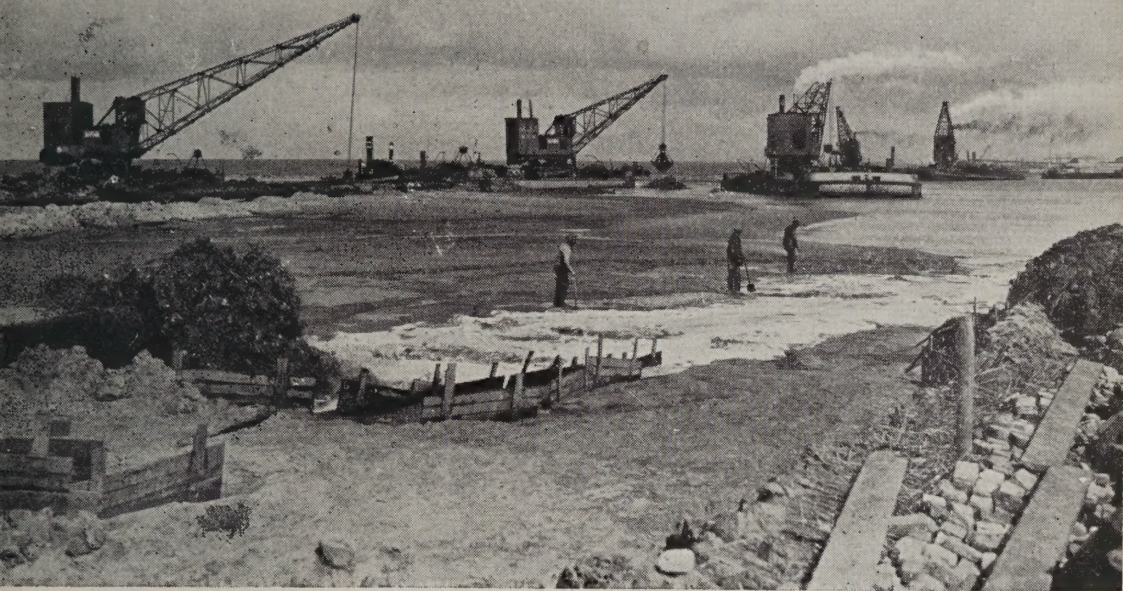


Fig. 10

passage of the tides became narrower and the force of the tidal-flow correspondingly greater. This ultimately caused such strong currents, that the work in progress was imperilled. The force of the current was at times so great that all the material discharged for the building of the dike was carried off by the current. It developed into a race between Man and water, a match in the speed of dumping material and carrying it off again. At one moment the current got the upperhand, it had reached such a velocity that beyond the current checking dam, a pool had been formed of no less than 28 meters deep. The current checking dam was in danger of disappearing into the deep. Should this have happened, then the struggle would have been lost.

This chapter is one of the most exciting ones of the story of the Zuiderzee works. There was no more sense in dumping ever larger quantities of boulder clay in the sea, the current carried it all off. There was not much time for deliberation, as the entire current checking dam could disappear at any

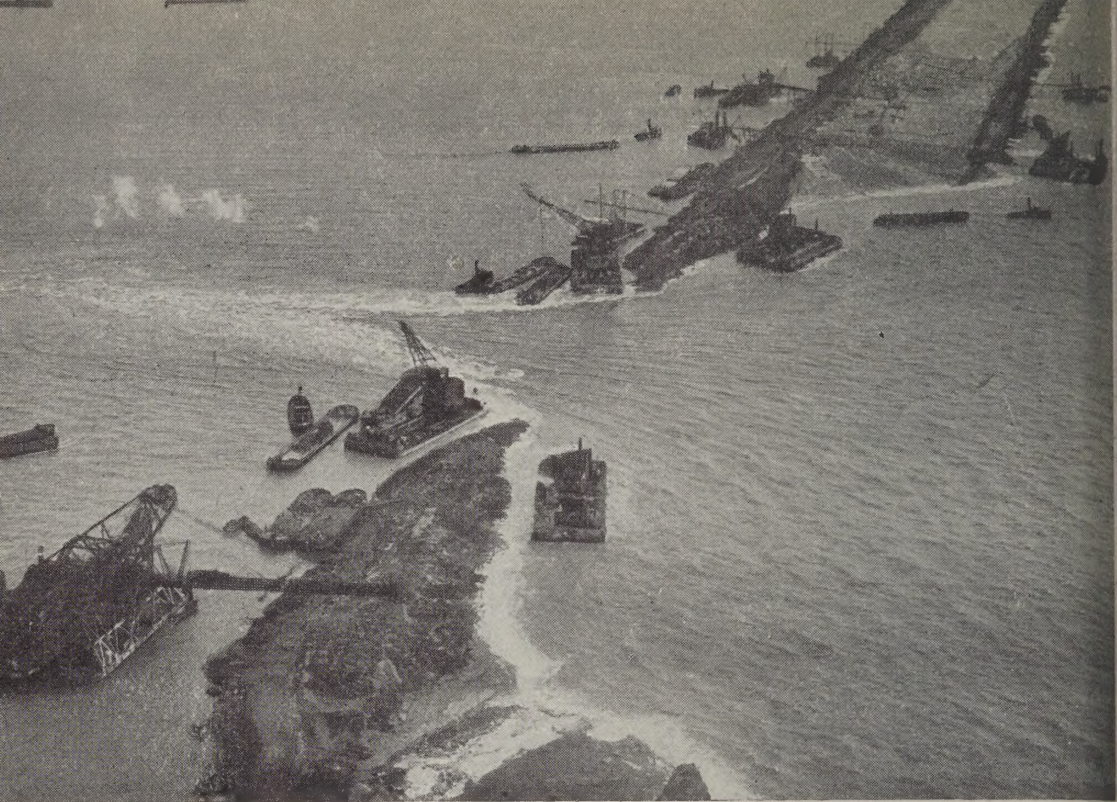


Fig . 11

moment and, moreover, there was a storm threatening from the South-West, which had already passed Flushing.

It was then decided to move activities some fifteen yards or so to the inside of the current checking dam. This had the advantage that not all the material immediately disappeared into the deep pool and it also gave some relief to the greatly weakened current checking dam. Furthermore, all chips, cranes, hopper barges, tugs and everything in the neighbourhood were directed to the threatened place to give a helping hand. After hours of almost super-human struggle, the day was won and the last gap but one was closed.

The supposition was justified that the struggle to close the last gap would even be very much greater. The suggestion was even put forward that it might not be possible to close the dike at all. However, after the closing of the last gap but one, the tidal-flow in the basin of the Zuiderzee ceased to exist. In principle the sea had relinquished the struggle.

Fig. 11 shows how the dike was temporarily enlarged at the place of the final struggle.

The closing of the last gap certainly caused great difficulties, on account of the large quantities of water that kept on flowing in and out, but the adversities experienced when closing the last gap but one, were happily not encountered. Fig. 12 gives an impression of the huge amount of water forcing its way through the last gap, a few hours before it was finally closed.

Fig. 13 shows the moment of the final closing of the dike on Saturday the 28th May, 1932 at two minutes past one in the afternoon. (page 28 and 29)

The victory was announced by the assembled vessels of every description with great noise of hooting. Many persons invited were present and numerous well-chosen words were spoken. For those who had actually been engaged on the construction from the very beginning, this was a mile-stone in their lives. Quite often the outcome had been doubtful and fine words were not able to express the infinite courage and tenacity which had been necessary to lead to this result.

Fig. 12



After this memorable and historical moment, when a sea ceased to exist, months were still required to complete the dike and when this was accomplished a simple monument was erected on the spot of the final enclosure.

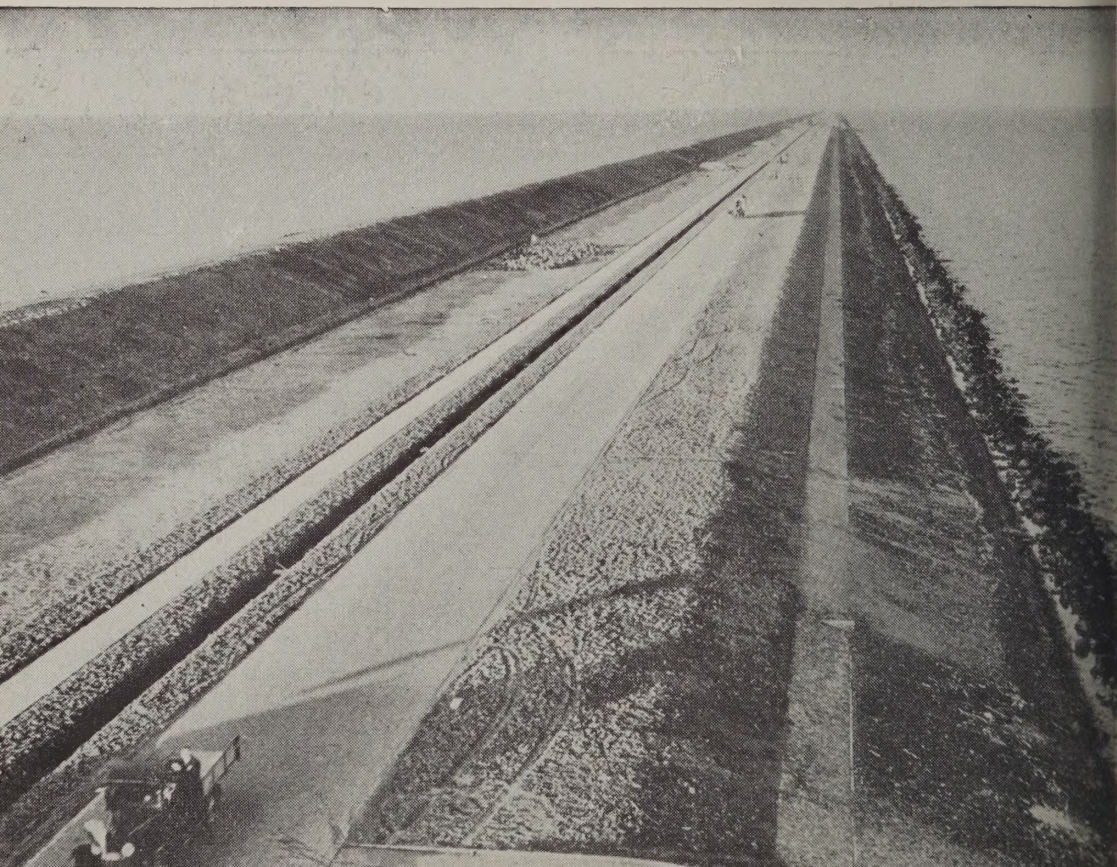
Fig. 14 on one side it bore the proud inscription: "Here the dike was closed, 28th May 1932" and on the other side: "A nation that lives builds for its future".

The dike was provided with a fine road for high-speed traffic, a track for cyclists and a foot-path for pedestrians and there was room for a double-track railroad.

Fig. 15 is a view of the dike as seen from the monument. On the right one sees the crown of the dike, which can effectively stop the crests of the highest waves and shelters the space for the railway-track, alongside which is found a track for cyclists and a path for pedestrians, a ditch for drainage purposes and finally the road for high-speed traffic.

The length of the dike between Wieringen and the coast of Friesland is 20 Miles, its width at water level is 250 feet.

Fig. 15



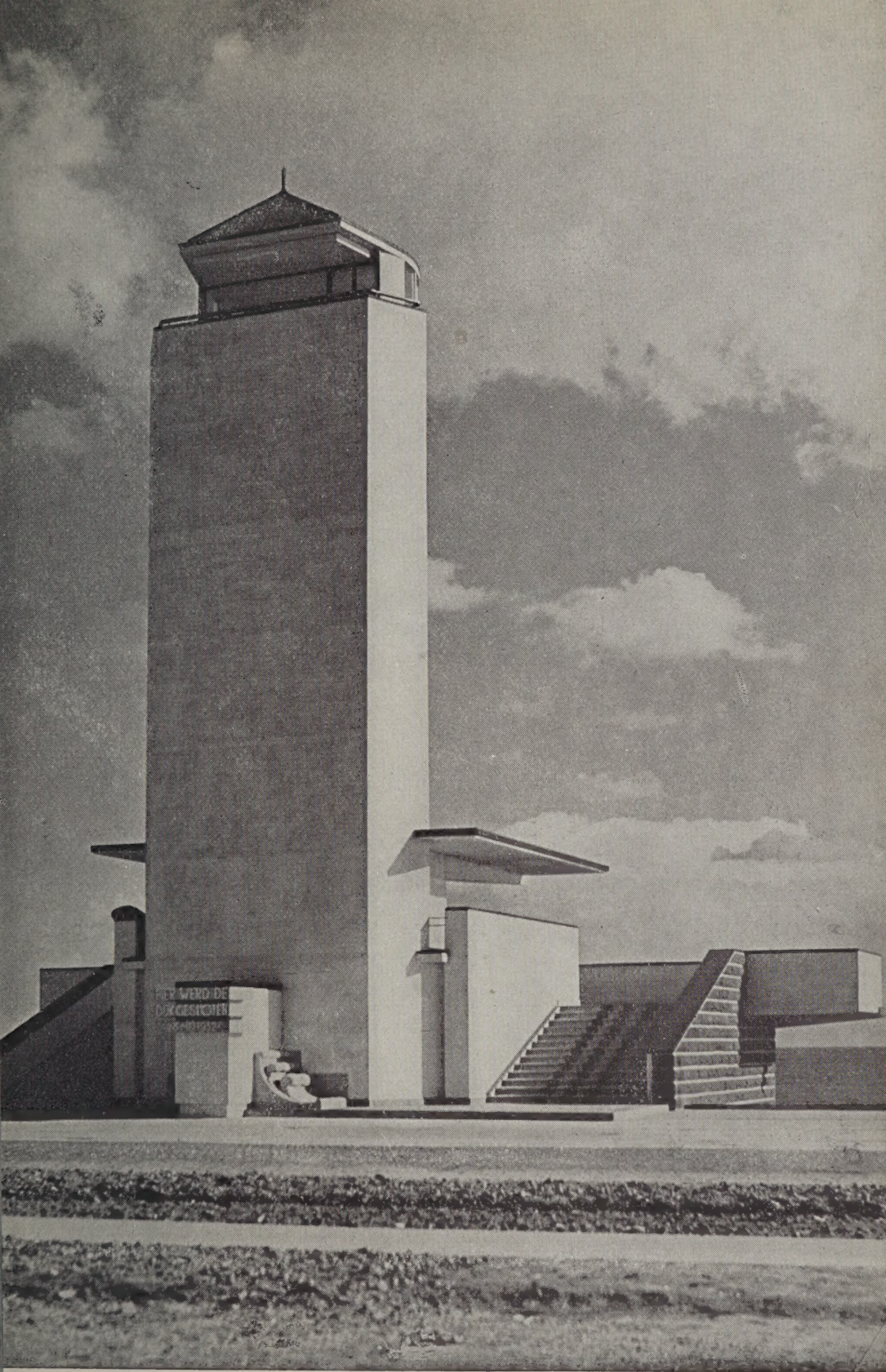


Fig. 14



Fig. 16

About 500 vessels were employed in constructing the dike, 88 of which were tug-boats.

THE POLDERS

However mighty the Zuiderzee dike might be, it did not constitute the object of the work and it only formed one part, though of the greatest importance. The aim was the creation of polders and the reclamation of land.

Before the completion of the Zuiderzee dike a small experimental polder had been constructed near the village of Andijk in the Province of North Holland. Here experiments were made with those crops, which would later on have to be cultivated in the larger polders.

Fig. 16 shows an aerial photograph of the experimental polder of about 100 acres.

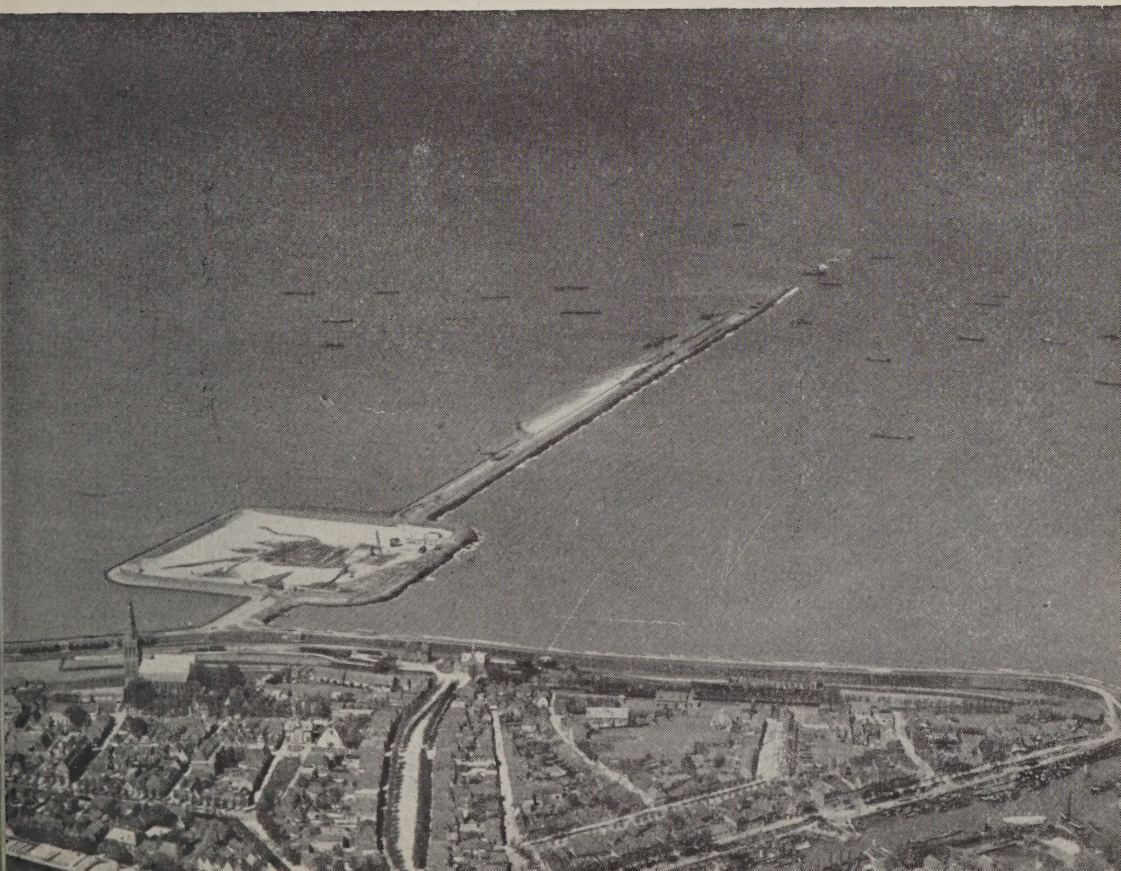
A beginning had already been made with the construction of the first polder in the Zuiderzee before the enclosure of the Zuiderzee had been completed. It was called the Wieringer-

meerpolder or "Wieringermeer" for short. Seeing the dike of the first polder would not have the full protection of the enclosure dike, high and low tide still being very much in evidence, the dikes of this polder had to be built heavier than those of the other subsequent polders.

In the year 1928 a start was made near the old town of Medemblik (fig. 17) with the construction of a building site for the future "Lely" pump station, which was named after the main promotor of the Zuiderzee works. The building of a similar pumping station, the "Leemans", was started at the North-East corner of the former island of Wieringen. This station was also named after one of the promotors of a plan for the reclamation of the Zuiderzee.

At either side of these pumping stations the construction of the dike was taken in hand and fig. 18 shows the construction of the dike in progress. The open space had been left for the sluice-system and the strength of the existing current can clearly be seen. In the background the coast of the Province

Fig. 17



of North Holland is discernable and just before the bend in the dike the working harbour "De Oude Zeug" named after a shoal. This harbour was used for the accomodation of floating equipment and the storage of material.

Fig. 19 is an aerial photograph of the Lely-pump station in action after the closing of the polder dike. It can be clearly seen that the level of the water in the future polder is already considerably lower than that outside. The Lely-pumping station is electrically driven having three pumps of a total capacity of nearly 260.000 gallons per minute.

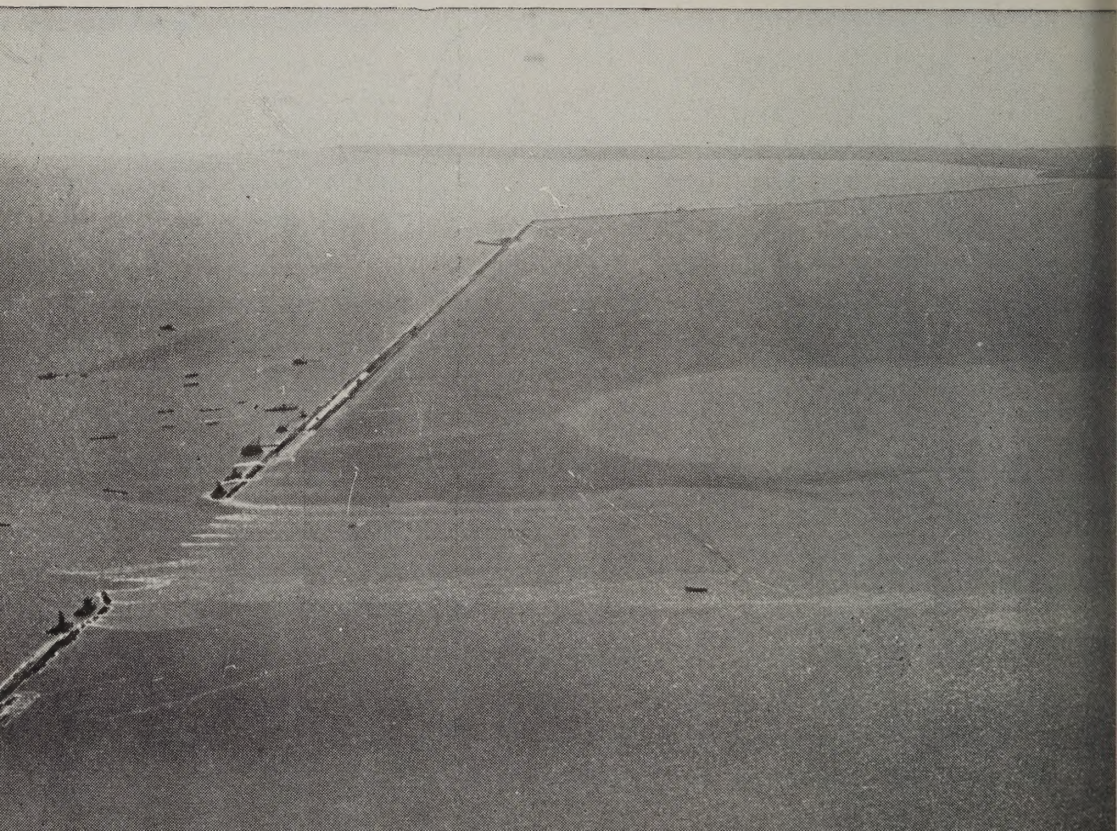
The pumping station "the Leemans" shown on fig. 20 has two enormous Diesel engines of a total capacity of more than 120.000 gallons per minute.

The pumping station "Lely" is by far the greatest of its kind in the world and the Diesel engines of the pumping station "Leemans" are among the largest in existence.

The dike of the polder was closed in the year 1929 and at the beginning of 1930 the pumping stations went into action.

20

Fig. 18



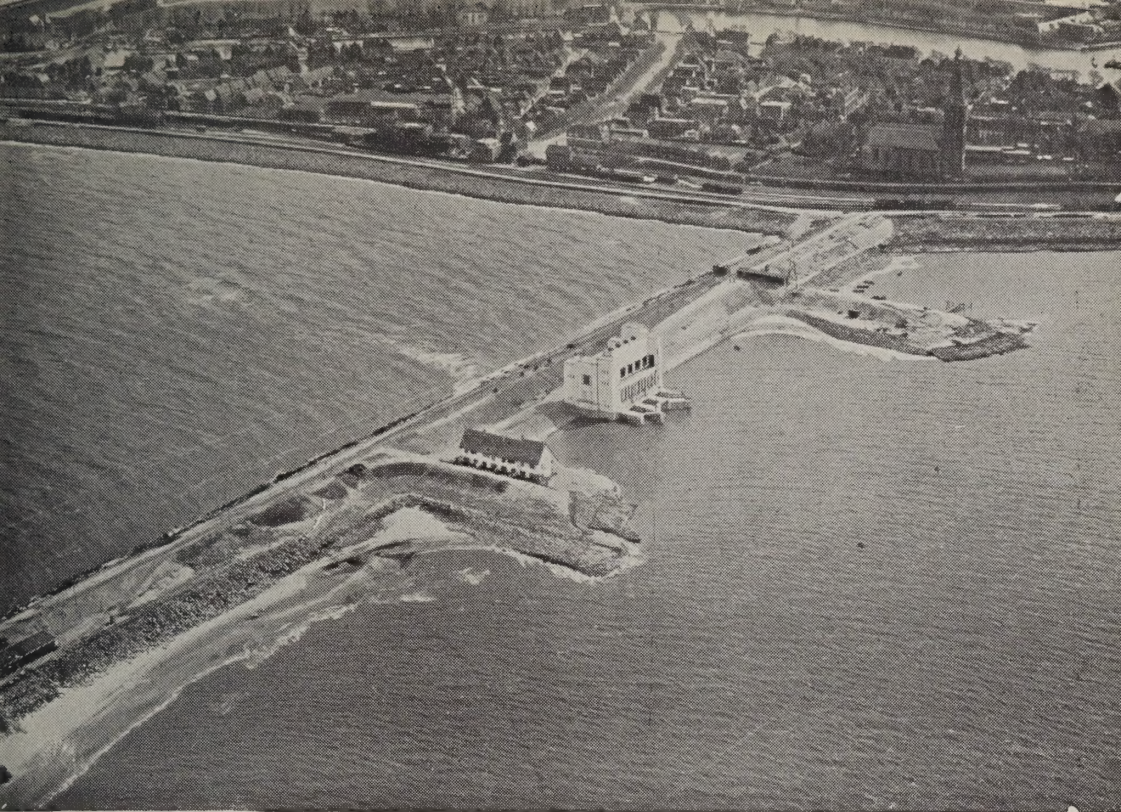


Fig. 19

For 8 months both pumping stations worked uninterruptedly at full capacity and by August 1930, the Wieringermeer had been pumped dry. In that year still the draining of the soil could be taken in hand.

That was easier said than done. The word soil suggests a solid substance fit for walking on. In reality the reclaimed land was but one great, soft mass of quaking soil, unfit to bear a human being, not to mention heavy machinery, motor-cars or other vehicles. Therefore, the main canals had been dredged before the polder had been completely drained. In this way one could avail oneself of a means of transport at the very outset. The canals, in the first place, promoted the draining of the new land immediately after the polder had been reclaimed. In the beginning transport in the polder took place by water and the first material conveyed was destined for road-building. Naturally the first roads had only an auxiliary function and they were not suitable for heavy traffic.

1 The workmen made use of them to perform the first essential



Fig. 20

work. It goes without saying that the work of primary importance was the digging of new ditches, which enabled the effective draining of the soil.

As soon as the condition of the soil allowed it heavier machinery was used and better roads could be built. Bridges were constructed and when things were at this stage, the work of putting the land under cultivation could be taken into hand energetically.

The digging of more than 25.000 Miles of ditches was, for the greater part, done by machinery.

Fig. 21. Ploughs of the type as shown and specially invented for this purpose, were used. Two ploughs were placed at a distance of several hundred yards from each other and a heavy tractor was stationed midway between. This tractor drew the two ploughs towards each other.

Fig. 22 is an aerial photograph of this work in progress. The ditches already ploughed are clearly to be seen. In the centre there is a space where the tractor — on the photograph a

black speck — has been placed. At either end two ditches are to be seen in progress of being ploughed, this is where the two ploughs are being drawn together. The excavated soil had to be spread out by hand at first, later on this was also done by machinery.

The digging of the larger ditches was also done mechanically. Such a ditch digging machine is depicted in fig. 23.

This piece of machinery was also especially invented for the purpose and it spreads the surplus soil mechanically. On the photo the ejected soil can be seen leaving the machine. After the soil had been drained sufficiently, the open small-sized ditches were replaced by drains, which favourably influenced the draining of the land up to a considerable depth and proved an excellent means of getting rid of the salt in the soil. In the experimental polder mentioned earlier, experience had been gained on the type of crop suitable for cultivation on the new land. After the salt content had decreased considerably, in consequence of the deep drainage

Fig. 21



system, several crops could be cultivated successfully. The land, from which the salt had not yet been extracted sufficiently, was first used for the cultivation of certain kinds of grass. This prevented sanddrifts and kept the weeds within bounds. As the extraction of the salt progressed, the land became gradually suitable for the normal, more productive crops.

The research in the experimental polder had given the solution to many and diverse problems, such as for instance the nature and type of fertilisers and manures required; the best distances between drains and ditches, etc., and principally the rotation and duration of various crops, which could be cultivated on the new land. The scientific research of the soil, as developed in the experimental polder, proved indispensable in the Wieringermeer.

Fig. 24 shows mechanical harvesting of the first crop, while, fig. 25 is a view of an ordinary Netherlands polderlandscape, two years after reclamation.

2

Fig. 22

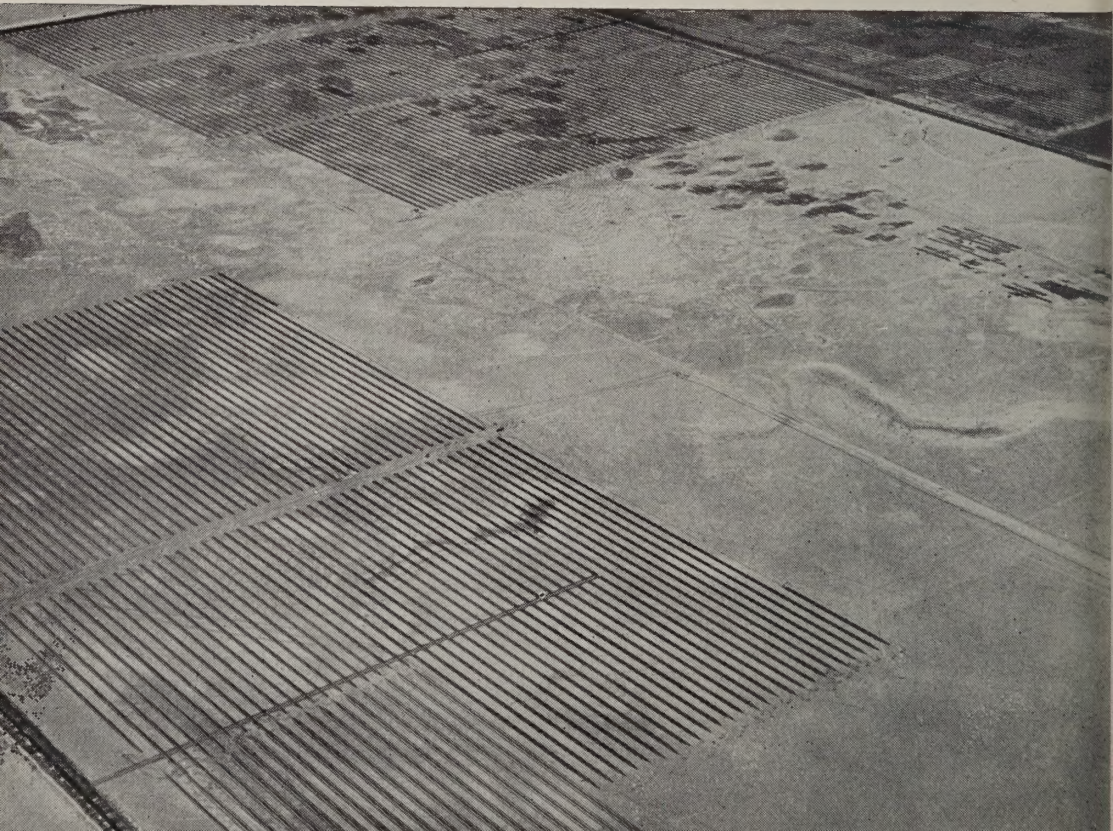




Fig. 23

The cultivation of the land, however, did not complete the polder. Villages had to be built, modern roads had to be constructed, water and electricity had to be laid on, and telephones to be installed, etc., etc.

Fig. 26 is a picture of the Alkmaarseweg in the Wieringermeer, in the year 1943.

Fig. 27 shows the Slootweg in the Wieringermeer also in the year 1943.

The new roads, which crossed the large number of canals required modern bridges. One of these is shown in fig. 28. A fixed bridge, constructed entirely of concrete. There are more than 40 bridges of this type in the polder, while there are many movable bridges across the main canals, which can be opened to enable shipping to pass. They total 59.

Hundreds of new farms had to be built, some of which are shown in 29, 30 and 31. The living quarters, as well as the farm proper, are most up-to-date, so that these homesteads are unequalled throughout the world. Apart from the fact that

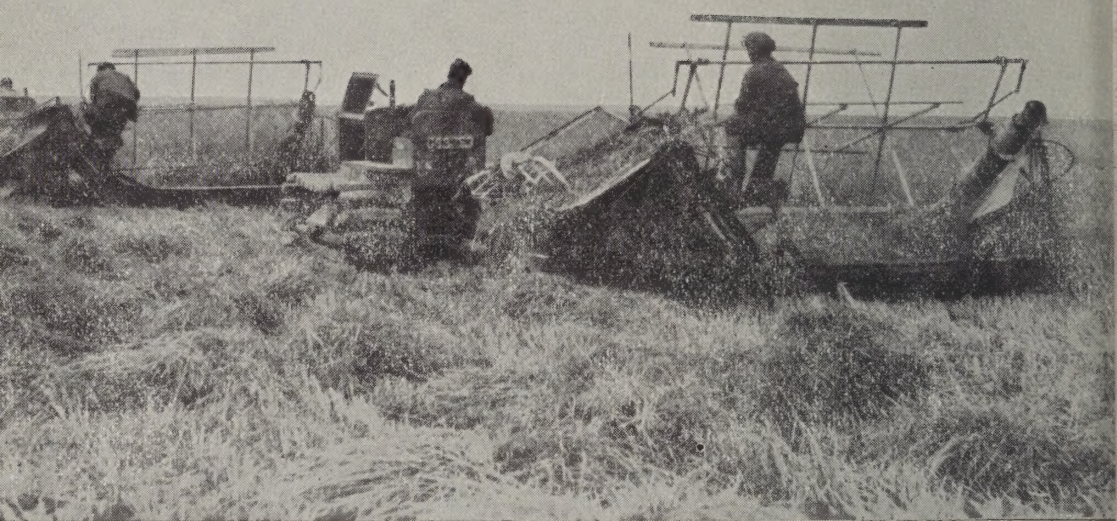


Fig. 24

Fig. 25



the new polder, of course, does not offer the entertainment of a metropolis, there is nothing that can in any way be called primitive. Practically each farm has a telephone, running water and modern sanitary appointments, such as water closets, furthermore roomy living- and bed-rooms, etc., etc.

The interior of each farm is of high standard both from an hygenic as well as from a practical point of view. The architectural appearance of the farms is excellent, without superfluous luxury.

Dependent on the nature and the kind of the farm, they have been divided into several types. All farms of the same type are principally the same, but they have slight variations, so that there is no question of monotony. The farmers are carefully selected, so that they may be expected to follow modern farming methods.

In the polder there are several centres, villages, where shops are found, tradesmen live, where the necessary official institutions are established and churches, schools and public buildings, etc, have been built.

Fig. 26



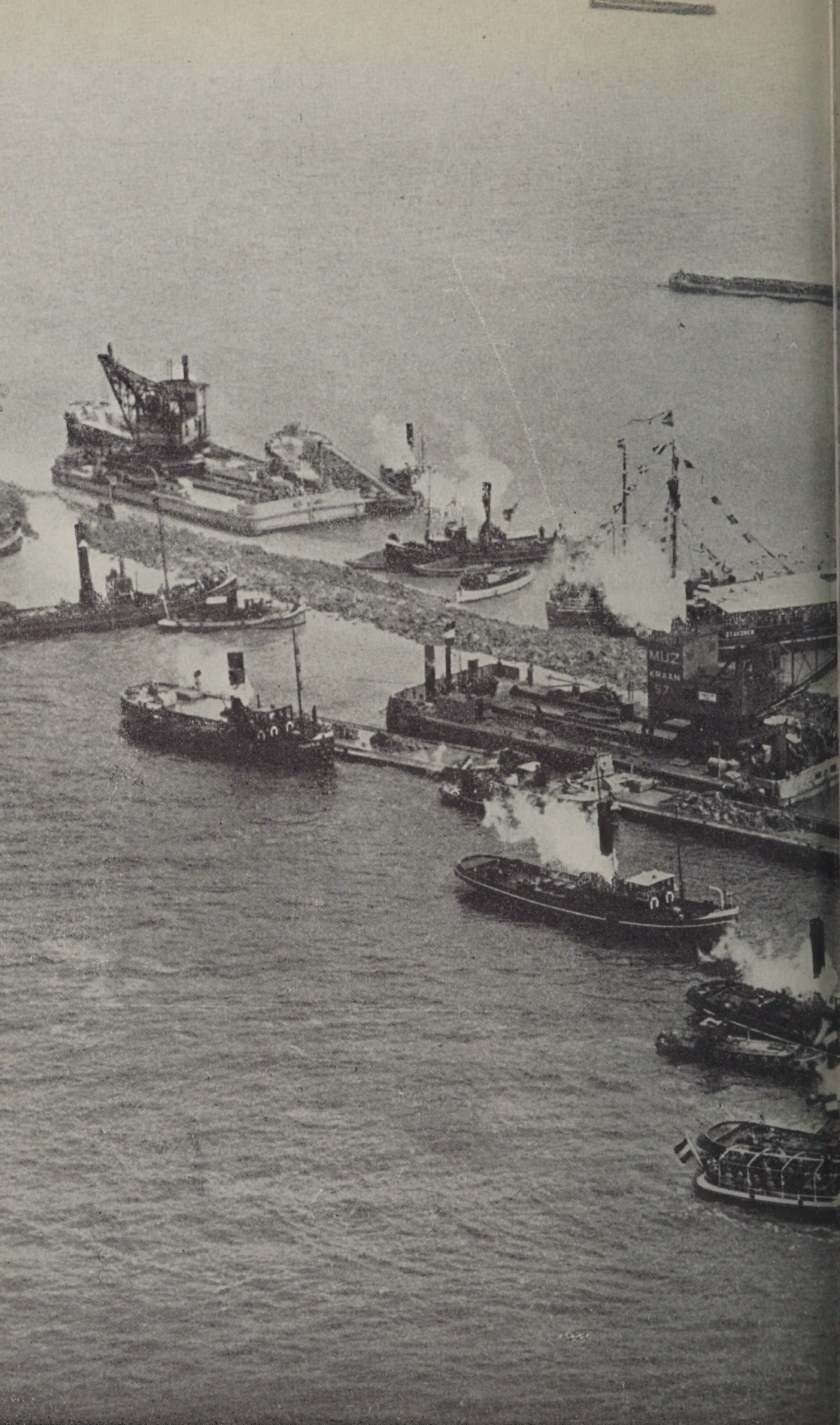




Fig. 32 is a photograph of the village Sloodorp in course of construction fig. 33 shows the village "Middenmeer" shortly before its destruction by the Germans in 1945, 17 days before the liberation. This photograph illustrates how well these villages were built and how inhabitable they were. No doubt, they might be classified as model villages.

Fig. 34 is a map of the Wieringermeer as it was completed just before the Second World War.

THE WAR

For the Netherlands the war broke out in 1940 and until 1945 the Wieringermeer did not suffer any damage from the war. The Wieringermeer was an ideal refuge for those who had to hide from the Germans for some reason or other. Practically without any exception the farmers in the polder were of the right kind and hundreds of young people were taken in hospitably and were hidden from the Germans. The Germans did not fail to notice that many of the persons

30

Fig. 27



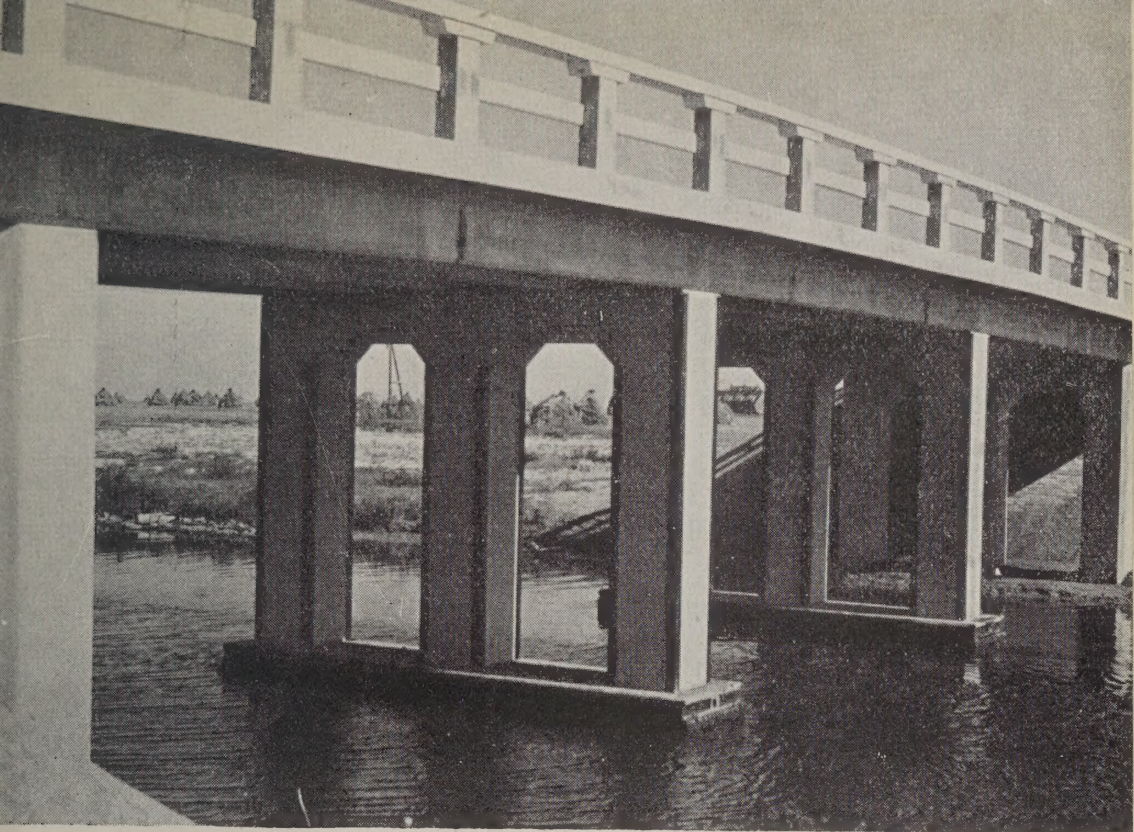


Fig. 28

Fig. 29





Fig. 30

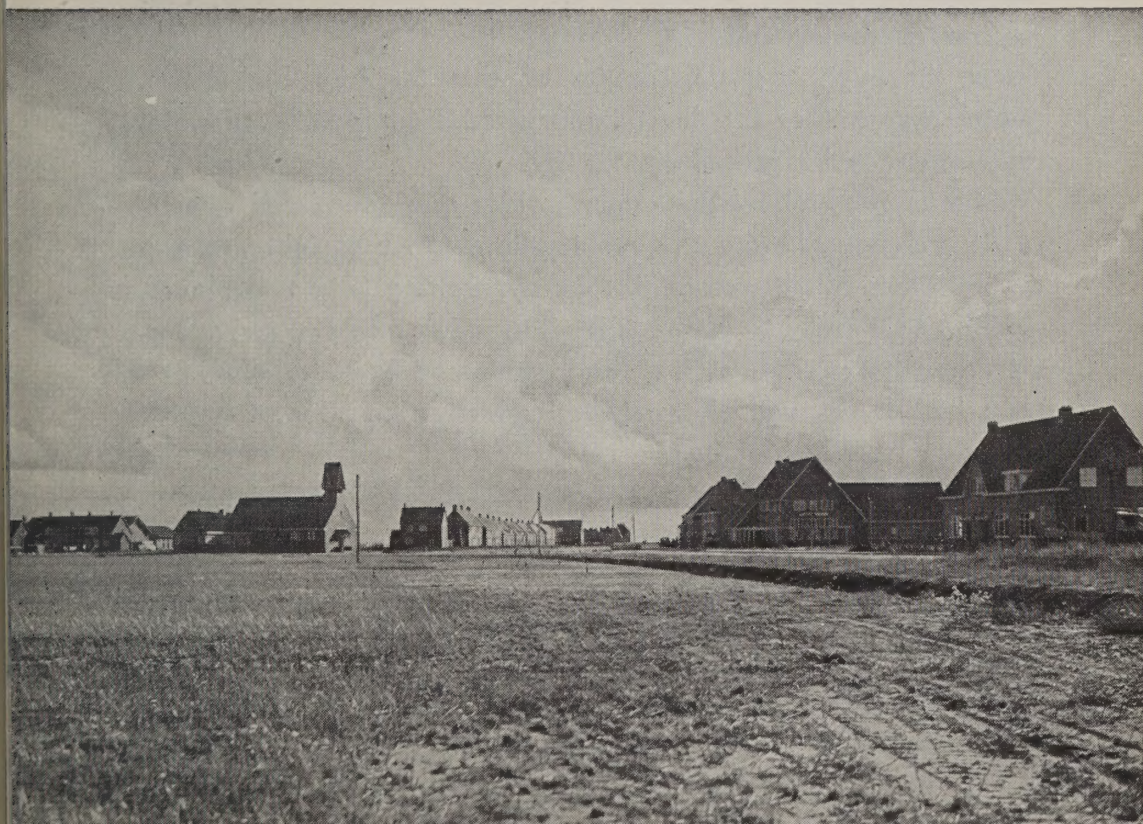
Fig. 31



wanted by them must have sought refuge in the polder, though they remained unfindable. The Germans were extremely jealous of this ideal land that had been reclaimed in such a peaceful manner and when at last it became apparent that the war was definitely lost and that they would have to leave this beautiful country and the great work the Dutch had accomplished, they destroyed the polder by dynamiting the dike in two places on the 17th April 1945 — 17 days before the official capitulation. And this happened notwithstanding an unofficial armistice had been concluded between the Netherlands officials and the German Commander a short time before. It had been agreed upon among other things that no destructions nor executions would take place in the Netherlands any more.

The population had to leave the polder at a moment's notice. Many of the young people, who had been in hiding, were arrested and a number of them were shot. The polder itself was completely inundated and the greater part of the buildings were destroyed by the water.

Fig. 32



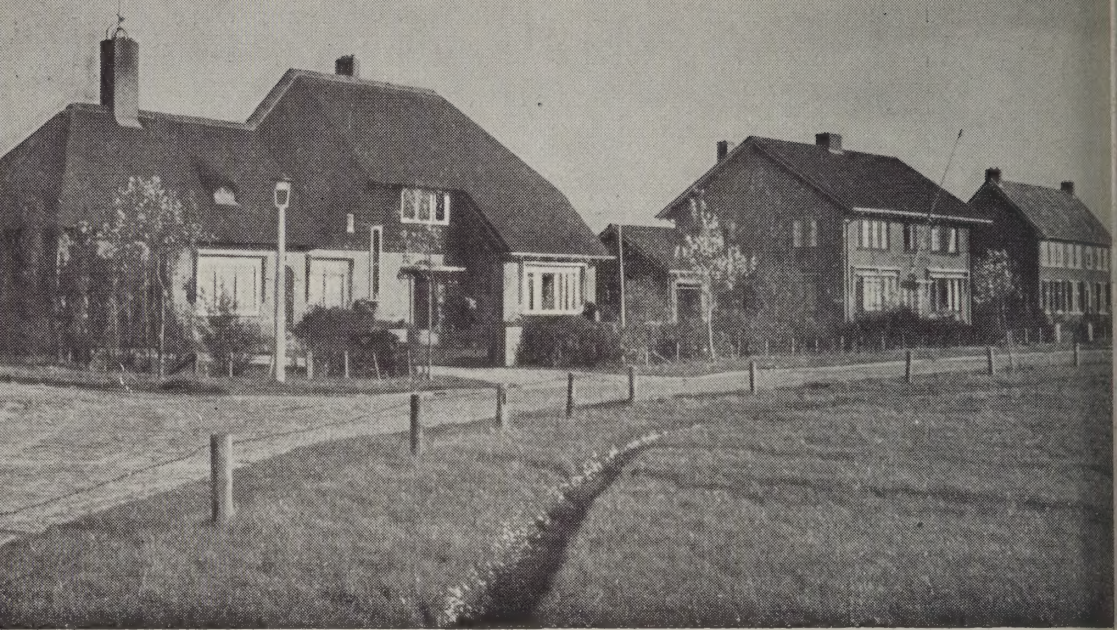


Fig. 33

Fig. 35 shows a part of the village Middenmeer before the destruction, fig. 36 is another view of the same village, also before its destruction.

How thorough the destruction of this territory had been, which was not of the least importance from a military point of view, may be seen from fig. 37.

This map shows how the entire polder was inundated exactly as it had been before the reclamation. On the right the gap in the dike, which was caused by dynamiting it in two places. Owing to the force of the inflowing water the two breaches, which were narrow at first, soon obtained a width of 650 ft and 525 ft respectively, between which a small part of the old dike remained intact.

Fig. 38 is a view of a street in the village of Middenmeer, before the inundation.

Fig. 39 shows the village during the inundation.

Fig. 40 is a photograph of the village after the second reclamation.

The motion of the waves completely destroyed the houses

WIERINGERMEER

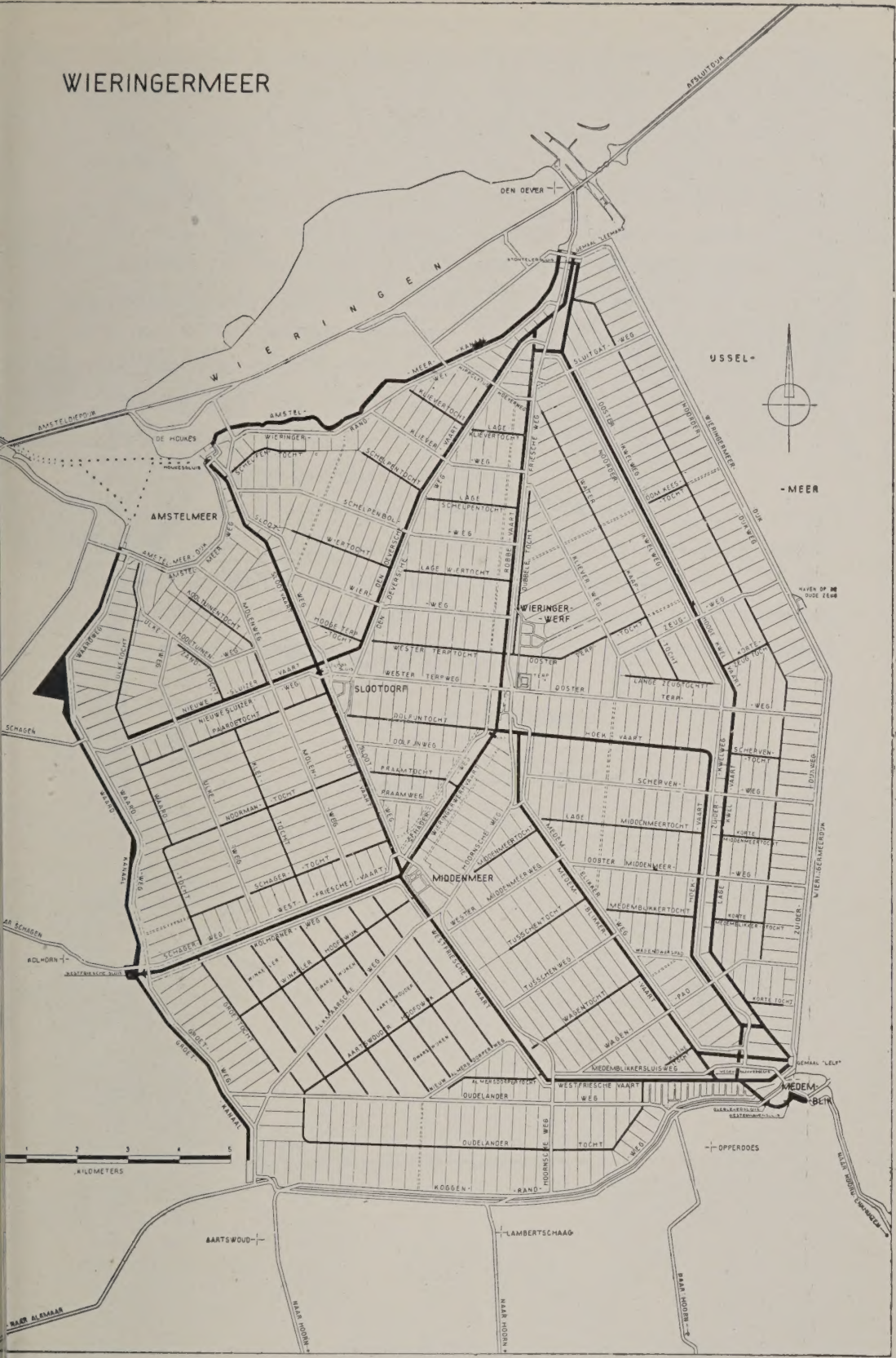


Fig. 34

THE FLOODED WIERINGERMEER.

WADDENSEA
(NORTH SEA)

IJssel-LAKE

DEN OEVER

DISCHARGING SLUICES

ISLAND OF
WIERINGEN

PUMPING STATION
"LEEMANS"

GAP, BLOWN BY
THE GERMANS
17th OF APRIL
1945

AMSTEL-
LAKE

PORT OF
OUDE ZEUG

INUNDATED 50.000 ACRES, NOW
RECLAIMED

POLDERS OF
NORTH HOLLAND

PUMPING STATION
"LELY"

MEDEMBLIK

Fig. 35

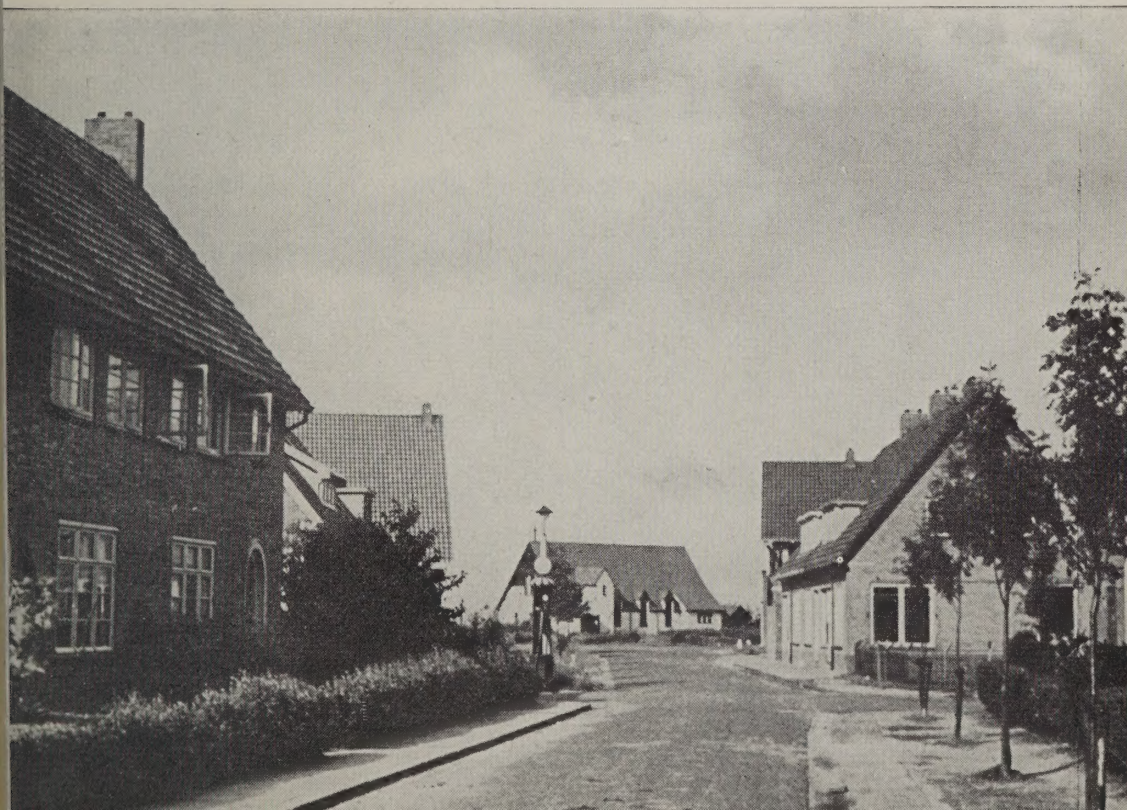
and those buildings which were still intact when the second reclamation started, collapsed during the draining. A single church and one or two buildings situated on higher grounds were partly saved, though they were without exception heavily damaged.

The Dutch Government, which had its seat in London during the war, had been buying a great deal of material for pumping purposes before the German capitulation and when the Germans capitulated on the 5th May 1945, it was possible to set to work energetically. The preparations for the repair of the dike were ready by the 21st June 1945 and three months after the German capitulation, on the 5th August 1945, the breaches in the dike were closed.

Fig. 41 shows how this was done.

The inflowing water had scoured the soil away to a great depth there where the old dike had been and also immediately behind it, it was, therefore, not possible to build the new dike on the old spot. The new dike was constructed in front of the old one, so that the deep pools were situated

Fig. 36



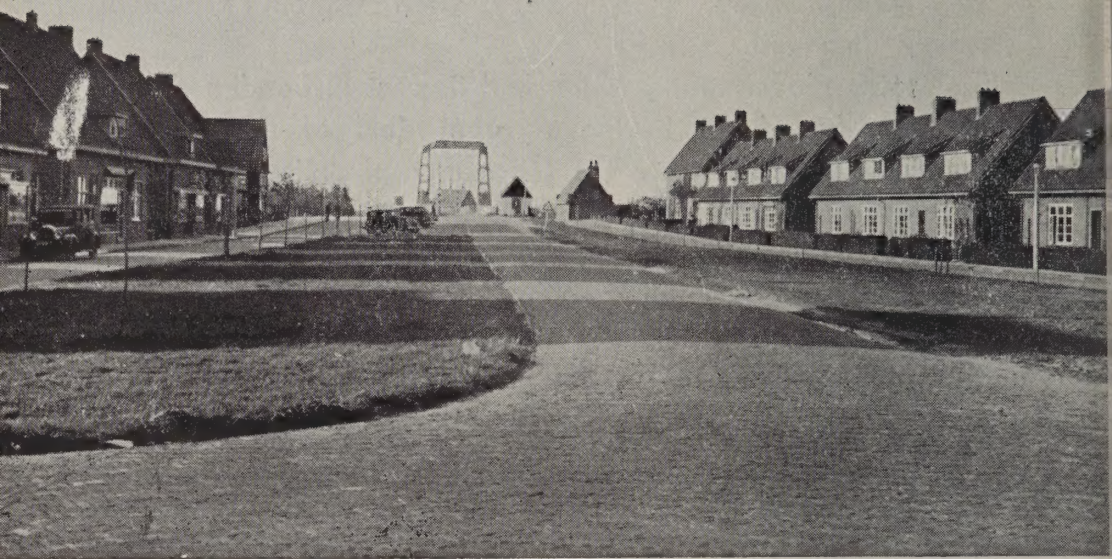


Fig. 37

Fig. 38



inside the polder. There they form two small deep lakes as a permanent reminder of the shameful deed perpetrated by the Germans. The inflowing water had covered the fertile soil with large quantities of sand carried away from the body of the dike, consequently, this fairly large area was spoilt for good. In order to limit the damage as far as possible, the sand covered surroundings of the lakes, are being planted with trees, so that in course of time this wooded area will become a natural reserve and beautify the landscape.

Apart from the two existing pumping stations, which were left practically undamaged, a number of auxiliary pumping stations were brought into action.

One of these is shown in fig. 42.

When, in 1930, the polder had been reclaimed for the first time, it had taken nearly eight months to drain it. About 600–700 million cu. metres of water had to be pumped out of the polder.

In 1945 the same amount of water had to be removed, but

Fig. 39





Fig. 40

this time it was essential to accomplish the work as quickly as possible, in order to save whatever was left, and that was only very little. Buildings were past repair and roads had become water-logged and spongy. It was, therefore, necessary to limit the motion of the waves when the water became shallow, to the shortest possible period. This in order to prevent serious damage to the structure of the land and the total destruction of roads. If this were unsuccessful, then it would mean that any form of transport would be impossible for some considerable time and the entire work of bringing the polder into cultivation would have to start from scratch. Neither trouble nor expense were spared in the effort to procure a harvest from the polder in 1946.

Apart from the two existing pumping stations and the auxiliary stations, there was still a considerable quantity of material which had been kept hidden from the Germans and which would otherwise have been stolen by them. Thus, by Christmas with the utmost exertion the Wieringermeer was

Fig. 41



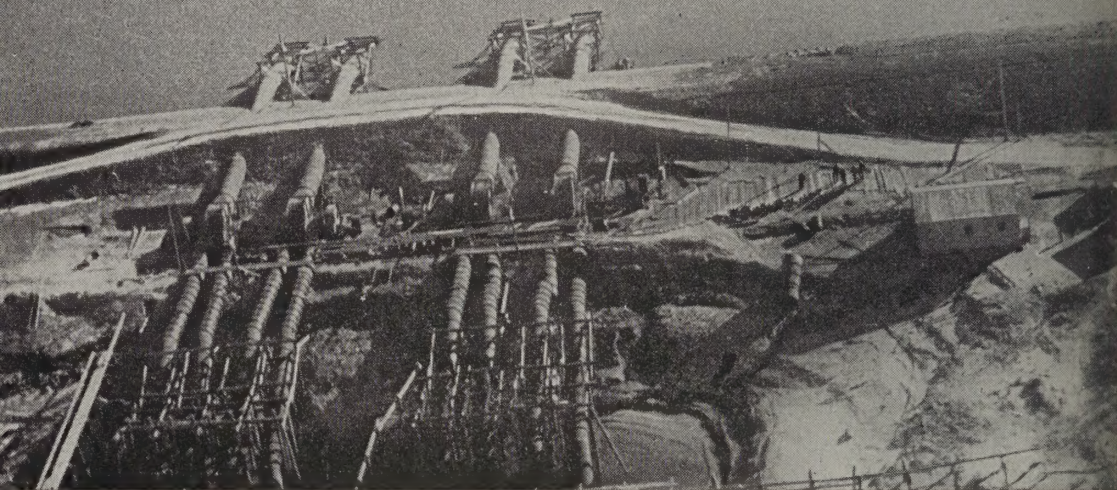


Fig. 42

once more dry land, three months ahead of the schedule set by the experts. Everything that was not level with the land had been ruined or damaged beyond repair. The only exceptions were the two pumping stations — the "Lely" and the "Leemans" — which apparently the Germans had forgotten to destroy.

Though all this was very encouraging, it was only the beginning. Fortunately, the water with which the polder had been flooded was not salt. The roads, canals and ditches had remained very largely intact, which was partly due to the rapidity with which the work had been carried out. The motion of the waves had not caused any great damage to the land. But those endless, monotonous, grey stretches of land, with no house undamaged, full of ruins and rubble, that was, for those who had known the polder formerly, a desolate and discouraging sight, moreover, the materials and the implements to repair the damage were exceedingly scarce. In 1930 there had been an abundance of everything, now the country had been ranksacked and looted and lacked the

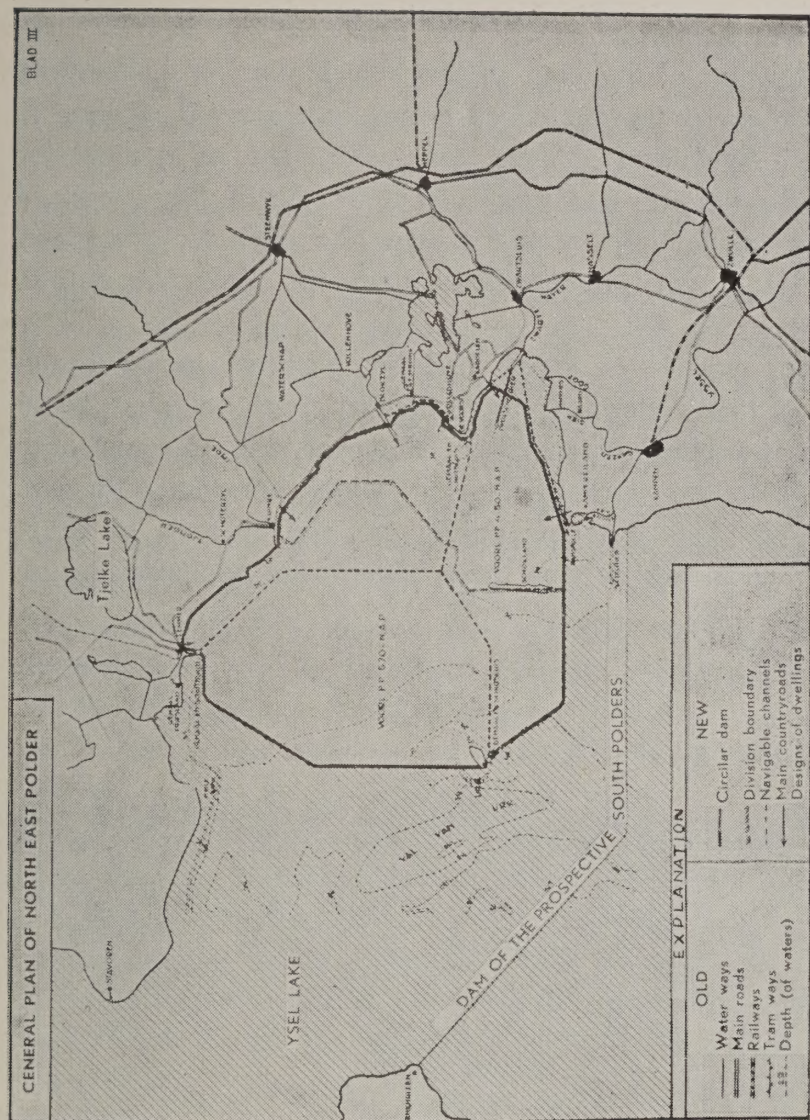


Fig. 43

necessary tools and material. It will, indeed, take years and years before the Wieringermeer will have again taken on the appearance of the years before 1945.

THE NORTH-EAST POLDER

The cultivation of the land of the Wieringermeer had hardly started when preparations were on their way to drain the projected North-east polder. The construction of a dike, for which see fig. 43 was begun in 1937. With the island of Urk as a connecting point, the dike also encircles the island of Schokland, which is now entirely situated within the polder, as shown in fig. 44.

The great experience which had been gained in the reclamation of the Wieringermeer, proved most valuable when draining the North-east polder. However, the circumstances under which the work took place, were somewhat different. In the first place the new polder covered an area of about 118.000 acres, which was more than twice as large as the

44

Fig. 44



Wieringermeer. Distance was an important factor in putting the new land under cultivation. In fig. 3 the difference in position is shown. The Wieringermeer is more or less sheltered by large parts of the province of North Holland, whereas the North-east polder juts out a great deal farther into the IJselmeer and borders on the provinces of Friesland and Overijssel. The parts of these provinces adjoining the "new land" are of a different structure than that of the North-east polder. Therefore, the necessary care will have to be taken at the juncture where old and new land meet. The difference in soil — the new polder consists for the greater part of a heavier type of soil than that of the Wieringermeer — naturally required other methods of cultivation, other kinds of fertilisers and a different crop rotation. Finally another difference might be mentioned. In the province of North Holland no river flowed into the IJselmeer at any place where the Wieringermeer had been projected. In planning the North-east polder the estuary of the river IJsel had to be taken into account.

The problem of extracting the salt was of less importance than it had been in the Wieringermeer. Since the enclosure of the Zuiderzee in 1932 the bottom had been covered first by brackish and later on by the fresh water of the IJselmeer. Therefore, the salt had already been more or less extracted from the top layers of the soil when the North-east polder was drained. More differences could be mentioned, but the foregoing, however, will serve to show that each new reclamation is not just a copy of a previous one.

A factor which would greatly delay activities had in the meantime made itself felt. The rumours of war circulating in Europe, were the cause that the Dutch Government had to pay attention to more urgent matters. The German occupation of the Netherlands in the years 1940 to 1945 impeded operations even more. Notwithstanding this, the dike was completed in December 1940 and the polder was drained in September 1942, only five years after the work had started. With the aid of three large pumping stations, respectively at Lemmer, Urk and de Voorst, the Dutch engineers succeeded in adding a surface of no fewer than 118.000 acres to the surface of the Low Countries in a remarkably short time.

Anyone who comes across the words "Polder" and "Inpoldering" immediately thinks of hydraulic works, and bridges, dikes, canals and pumping stations pass through his mind. Indeed, without our technicians we should have been helpless. When the polder is drained and the muddy, boggy and inaccessible land appears, then the surprised visitor wonders how this waste, stretching as far as the horizon will ever be turned into farm land. Land where yellow undulating corn fields are succeeded by green fields with peacefully grazing cattle, where church spires vie in picturesqueness with the red-tiled roofs of farms. When hydraulic engineering has finished its task, then it is the turn of specialists of another, no less important group. They must make this waste land habitable, test the soil, prepare the land for farming and parcel it out, etc., etc.

The Dutch have learned much about the reclaiming of land in former centuries. Then there was no question of any rules and regulations governing housing and working the land. Anyone who wanted to do so could go and live in the new territory. It will be easily understood that this unorganized settling led to conflicts, which hindered the development of the "new land" considerably.

In the 20th century "natural selection" was superseded by a method, whereby unexpected adversities and great risks, encountered in the first years, were no longer borne by the individual but by the Community. Agriculture, botany, microbiology and archeology, all these branches of science contributed to making the North-east polder into a territory of which each Dutchman is justly proud and where living is worth while.

Preparing the North-east polder for cultivation took place under circumstances which are among the darkest in the history of the Netherlands. The German conqueror deported young people to the East in ever increasing numbers; many of them tried to escape from the clutches of the oppressor and went into hiding in the polder, where the enemy could not find them easily. This was, therefore, the reason why many young people, who in normal times followed a variety of professions and trades hid in the polder, where they could find work on

the land. Ditches and drains had to be dug, and this took place for the greater part by hand, because in time of war the necessary machines were lacking. Among this motley collection of workers there was one group which soon drew attention by the great interest which they took in their work. They were the farm labourers and sons of farmers originating from the "old land", and who owing to lack of farmland saw a possibility of obtaining an option for a holding in the North-east polder by working hard in the first difficult years. These pioneers as they called themselves later on, still form a separate group in the new Community, which is arising in the North-east polder.

After the liberation in the month of May, 1945, the work, which had been postponed on account of the war, could be taken in hand again — it had been touch and go whether the North-east polder was to have been inundated. Now new difficulties arose. Many who had spent the war years in the polder had only been there from sheer necessity.

Numerous brain-workers, whose constitution was not equal to the heavy manual work required, left the North-east polder as soon as they could in order to resume work in their former occupations. It was felt as a greater set-back when many of those who were capable of doing the work, also left the polder, either because they wished to return to their old trades or they received more advantageous offers to go and work elsewhere in post-war Netherlands. By mechanization in Agriculture, which was anyhow making itself felt more and more, the shortage of labour could be made good.

Fig. 45 is the photograph of one of the most up-to-date agricultural machines, which cuts the grain and delivers it threshed in bags.

Gradually the new land had been provided with a road- and canal-system. The total road net-work amounts to about 295 miles, which is approximately the distance from The Hague to Paris!

Now this enormous territory had to be put under cultivation. The State manages the land for the time being. It is, however, the intention to enable private persons to lease land as soon

as the necessary farms can be built. Holdings of 30 acres, 60 acres, 90 acres and 120 acres will be available allowing of a harmonious social-economical structure. The smaller holdings will be found near the villages which are to be built on the new land. The owners of the larger holdings, situated at a greater distance from these centres, will no doubt possess means of transport with which they can easily reach the settlements.

Fig. 46 shows a farm in the Eastern part of the polder. By planting trees and shrubs the house is protected against the wind, which is seldom absent in this low land. At the same time the homestead in this way breaks the monotony of this immense expanse.

Above we spoke of villages which will have to be built in the polder. This neither is left to chance. Formerly such settlements sprang up in places where the settlers went to live together at the crossings of roads, canals and other traffic-junctions. These sites are still taken into account, but attention is now also being paid to considerations, which play an important role in founding such centres. The agricultural labourers should not live far away from the farms where they have to work; the schools for the children should be within reasonable distance, and on account of the cultural side of life, churches and club-houses must be within easy reach for everyone.

In the North-east polder we find that an entirely new community has sprung up, which is composed of elements from all layers of the Netherlands populations. This group of people which has come together in the "new land", has the specific features of all new settlements. For many a farmer this polder offers a unique opportunity of obtaining fertile soil in an otherwise densely populated Netherlands. With energy they devote themselves to their task, knowing that everything will be done to make it possible to attain their end. Unstinted advice is given in many a field, while social and other provisions are at every one's service.

Fig. 47 shows the temporary hospital of the North-east polder in the neighbourhood of the former fishing-port of Vollenhove. The principal town of the "new land" has been planned in



Fig. 45



Fig. 46

the centre of the polder and surrounding it in a wide circle ten villages as will be seen from fig. 48.

These settlements have been named after towns and villages which are said to have existed here centuries ago... First to be built was the town of Emmeloord, where in the future the central services and public undertakings are to be established.

Fig. 49 shows a row of working-class houses in the future town of Emmeloord, in the background the temporary town-hall of the polder.

Much of course could still be said about this beautiful country, about the plantation of which fig. 50 gives a good impression, the establishment of businesses and shops, the division of the North-east polder into municipalities, the population, which, when this territory is fully developed, will number 40.000, these are all subjects about which much could still be told.

THE REMAINING POLDERS

In the meantime the great work is going on. A start has been made with the reclamation of a further new polder. The original plan to drain the South West Polder first, i.e. the polder bordering on the coast of the province of North Holland, has been dropped. The so-called Oosterpolder, which forms approximately the northern part of the large South East Polder, will now be taken in hand first.

Fig. 3 shows the position of this East Polder, which will have an area of approximately 52,000 hectares or 128,000 acres. In the south-east (separated by a border lake) it adjoins the coasts of the provinces of Overijssel and Gelderland, the Yssel lake the future Middenkanaal (Central Canal) (the connection between the Yssel Lake and the IJmeer) and the future South polder. Near the towns of Harderwijk, Elburg and Kampen there will be connections with the old land. Furthermore a bridge has been planned between this polder

Fig. 47



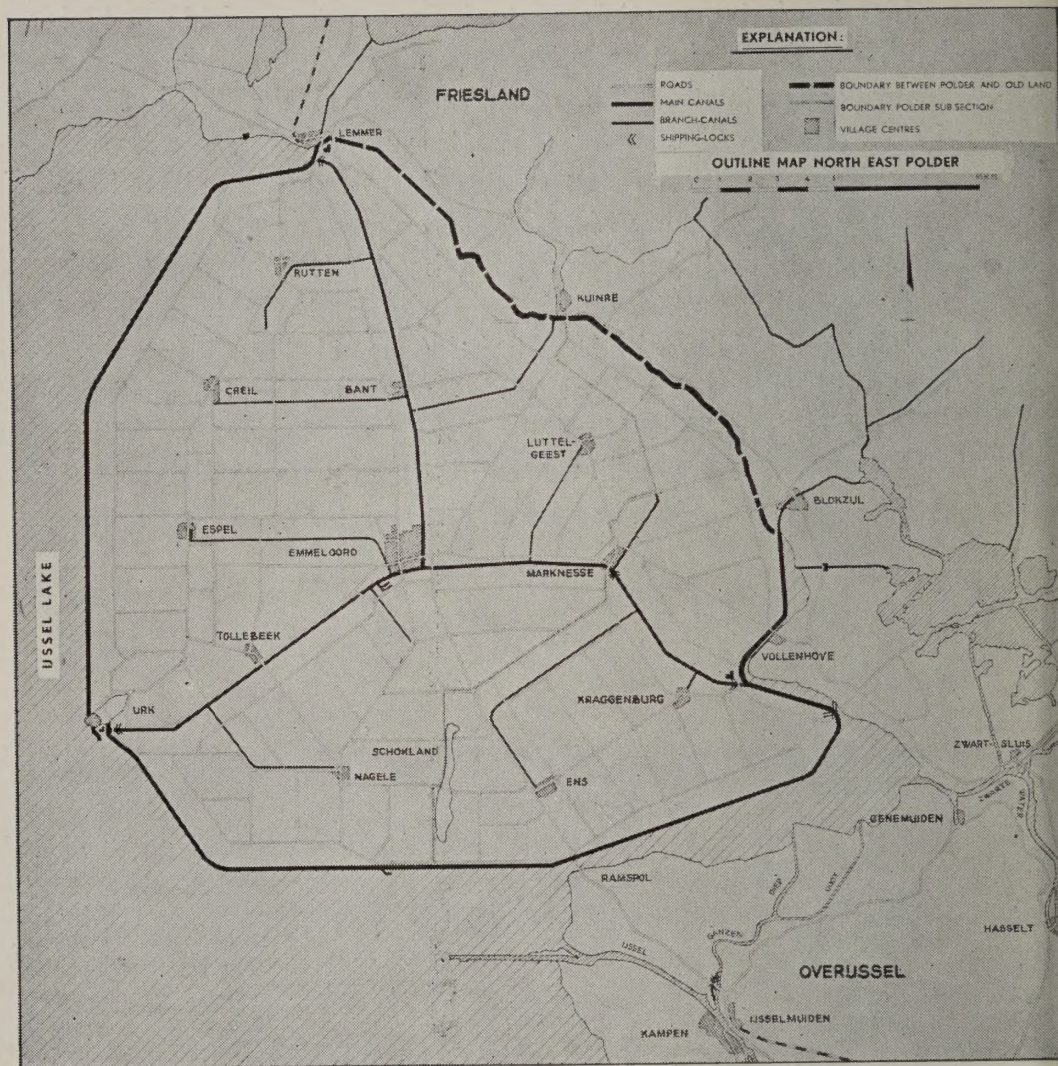


Fig. 48



Fig. 49

and the North East polder. Three pumping stations will reclaim the polder and keep it drained. Important arterial roads will intersect this polder and it will be one of the most fertile of the Netherlands.

The following are some of the reasons why the East Polder was now selected for reclamation:

The East polder forms the logical connection with the North East Polder which is in course of being reclaimed. The main centre for the East, South and West polders which has been planned near the Middenkanaal and which will also serve as the provincial capital of all the polders situated in the central part of the IJssel Lake, can now be developed immediately. The bridge planned between the North East and the East Polders will enable a close contact between these polders and also between those which will be reclaimed later on.

Work has already been begun on the enclosing of the East Polder, which is expected to be drained by 1956. Then it will take 7 years to make the polder suitable for cultivation.



Fig. 50

Finally there still remain the West and South polders for reclamation, these have a surface of 54.000 and 45.000 hectares or 133.000 and 111.000 acres respectively.

When all the polders have been drained the Netherlands will be enlarged in surface by about 550.000 acres, which works out at 7 percent of the totale area and at 10 percent of the land under cultivation. Though filled with awe for this great work, many people will wonder why the Netherlands are making such an enormous sacrifice in reclaiming these extensive parts of the former Zuydersea. There are indeed very urgent reasons which induced the Netherlands government to undertake this reclamation. In the first place the Netherlands is a very closely populated country, and the population is steadily increasing.

This small country has a population of 10.000.000 people or in other words more than 300 per square kilometre. Reclamation is essential to meet the food situation and the require-

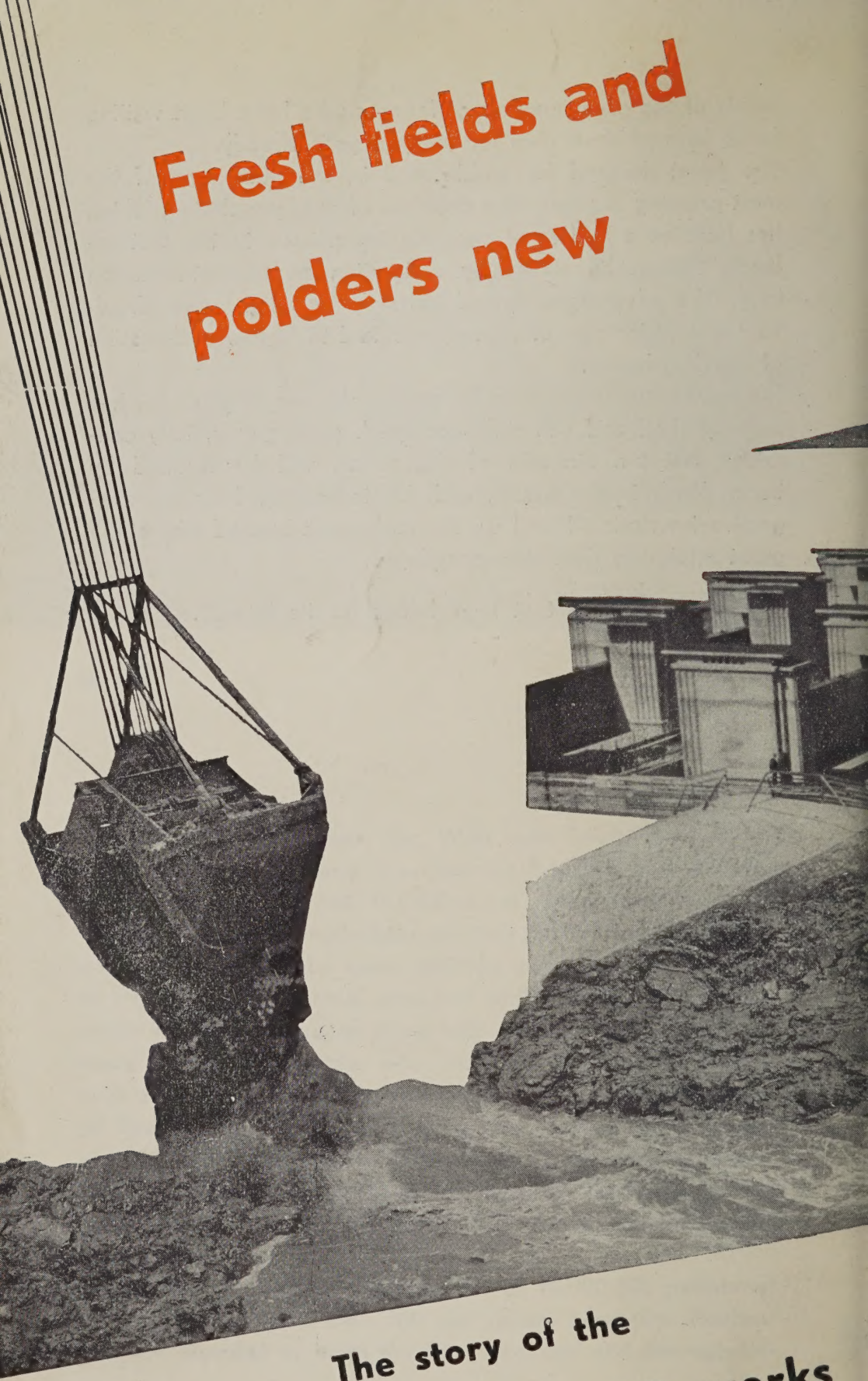
ments of the great number of farmers who have been waiting for a farm of their own for many a year already.

The great demand for arable land is, therefore, one of the most pressing motives. The problem of over-population, which has become a matter of supreme importance in the Netherlands, cannot be solved by emigration and industrialization only. The advantages gained certainly outweigh some disadvantages which are, of course, attached to further reclamation of the Zuydersea.

From the foregoing it may be evident how a small nation has accomplished and will still accomplish great works, fully confident that the strength of the nation will be fortified by these deeds in the future, and this is expressed by the suggestive inscription found on the monument located where the great enclosing dam was completed:

"A nation that lives builds for its future".

**Fresh fields and
polders new**



The story of the
Zuiderzee works

⑥

KELLOGG

**FOURTH INTERNATIONAL CONGRESS
OF SOIL SCIENCE
1950**

**GUIDE
TO THE
POST-CONGRESS EXCURSIONS
THROUGH BELGIUM**

I. - EXCURSION GHENT

(AUGUST 14-15th-1950)

FOURTH INTERNATIONAL CONGRESS OF SOIL SCIENCE

1950

GUIDE TO THE POST-CONGRESS EXCURSIONS THROUGH BELGIUM

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(AUGUST 14-15th-1950)

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MAPS

1. General soil map of the Ghent area.
2. Reconnaissance map of the « Land of Waas ».
3. Detailed soil map of a part of the « Land of Waas ».
4. Schematic cross-section of « Bolle Akkers » (rounded fields).
5. Detailed soil map of a part of the « Land of Aalst ».

GENERAL INFORMATION

The excursions of the Ghent Centre which will take place on the 14th and 15th of August 1950, are provided by the Ghent section of the General Soil Survey of Belgium, and carried out under the auspices of the I.R.S.I.A. (Institute for Scientific Research in Industry and Agriculture).

During the excursions, explanations will be given in English and in French. The principal data are given in this guide-book.

Excursion-centre.

The meeting-place of the excursion will be: Hôtel-Restaurant « Cour St. Georges », 46, Hoogpoort. Telephone 547.33, Ghent.

Excursion-groups.

The participants will be divided into 2 groups, A and B. Each group will be guided by two group-leaders. The groups will be divided in accordance with the list, — page 6-8. Alterations may be made on demand, during the visit to the State Agricultural Institute of Ghent, on August 14th between 9.30 and 12.00 a.m.

Group A will take the 2 grey-blue motor-buses.

Groupe B will take the yellow-red motor-bus.

Guidance.

Ir. F. R. MOORMANN — Geological Laboratory, 6, Rozier, Ghent. Tel. 574.24.

Ing. M. DE BOODT — Room n^r 235 - State Agricultural Institute, 233, Coupure, Ghent. Tel. 533.38.

have been charged with the general direction of the Ghent excursions.

The names of the leaders of the excursions are mentioned in the excursion programmes. For general information, refer to Ing. M. DE BOODT. Correspondence in connection with the Ghent excursion days, may likewise be sent to his address.

Excursions for ladies.

Should the matter rouse the interest of the lady-participants, the following excursions have been planned :

Monday, August 14th : A visit to the old town of Ghent.

Tuesday, August 15th : A visit to Bruges and to the sea-coast.

Those interested in these excursions are requested to apply to :

Miss J. LOWAGIE,
233, Coupure Links,
Room 68 — Teleph. 533.38, Ghent.

on Monday morning, August 14th.

Luggage.

The luggage, which reaches Ghent on Sunday, August 13th, will be conveyed to Leuven by motor-truck on Tuesday, August 15th. This luggage, duly labelled and bearing the Congress number and the name (block-letters) should be delivered on Tuesday morning in the hall of the hotel « Cour St. Georges ».

Accommodation — breakfast — lunch — dinner.

The participants will be put up at the « Cour St. Georges », 46, Hoogpoort, Ghent, or at any other hotel given by the direction of the « Cour St. Georges ».

The subscription for the Ghent excursion days covers the following expenses :

Sunday : August 13th : dinner;

Monday : August 14th : breakfast, lunch, dinner;

Tuesday August 15th : breakfast, lunch packet.

At Aalst and St. Niklaas, coffee and other drinks will be served during the excursions of Tuesday, August 15th.

Any other consumption will be at the expense of the participants.

Transport.

All the traffic during these excursion days will be done by bus. The participants should take the buses and occupy the places assigned to them according to the list.

The place and the hour of departure are mentioned in the time-table.

The following regulations were agreed upon as regards the excursion of the ladies :

Monday afternoon : a visit on foot through the town of Ghent - departure from the hotel « Cour St. Georges ».

Tuesday : a visit to Bruges and the sea-coast by bus — departure from the hotel « Cour St. Georges ».

The bus will join the other excursion groups at Louvain — Arrival at Louvain at 7.00 p.m.

Payment.

The whole of the Belgian excursion fee (Ghent-Louvain-Gembloux) is to be paid on Monday morning, August 14th, room n^r 68, State Agricultural Institute, 233, Coupure, Ghent.

Exchange.

An exchange office will be opened in room n^r 68, State Agricultural Institute, 233, Coupure, Ghent, on Monday morning, August 14th.

LIST OF PARTICIPANTS TO THE EXCURSIONS OF THE CENTRE GHENT

(August 14-15th 1950)

GROUP A.

G. Ableiter	294	Beltsville - U.S.A.
Mrs. Ableiter	295	Beltsville - U.S.A.
W. Albrecht	232	Columbia - U.S.A.
Mrs. Albrecht	233	Columbia - U.S.A.
E. Archibald	300	Ottawa - Canada
A. Asqhar	545	Pakistan
H. Atkinson	196	Ottawa - Canada
B. Avery	264	Bristol - Gr. Br.
A. Ayres	257	Honolulu - U.S.A.
Mrs. Ayres	258	Honolulu - U.S.A.
R. Bach	336	Zürich - Schweiz
J. Bonnet	259	Rio Piedras - U.S.A.
R. Bradfield	532	Ithaca - U.S.A.
Mrs. Bradfield	533	Ithaca - U.S.A.
W. Brind	204	Harpenden - Gr. Br.
P. Bruin	10	Groningen - Nederland
J. Bennema	62	Loenen - Nederland
P. Buringh	29	Wageningen - Nederland
J. Butyn	86	Wilhelminadorp - Nederl.
D. Campbell	424	New Sealand
Mrs. Campbell	425	New Sealand
D. Codinho-Gouveia	506	Port. East Africa
Mrs. Codinho-Gouveia	506a	Port. East Africa
H. Cooper	387	Clemson - U.S.A.
F. Dechering	358	Oosterbeek - Nederland
H. De Roo	77	Bennekom - Nederland
L. De Smet	483	Winschoten - Nederland
J. De Geus	332	Indonesia
J. De Lange	163	Amsterdam - Nederland
G. Deloffre	73	La Madeleine - France

G. Demortier	285	Gembloux - België
G. Den Dulk	372	Wageningen - Nederland
C. Edelman	4	Wageningen - Nederland
H. Finielz	341	Tunis
B. Furneaux	167	Brenchley - Gr. Br.
G. Gaucher	528	Algerië
V. Greenstreet	310	Zomba - Africa
J. Haans	89	Steenwijk - Nederland
K. Haasjes	412	Utrecht - Nederland
T. Hall	218	South Africa
Miss Hall	219	South Africa
F. Hardy	150	London - Gr. Br.
A. Hernot	341	France
K. Hoeksema	530	Wageningen - Nederland
R. Hockensmith	200	Washington D-C, U.S.A.
V. Ignatieff	388	F.A.O.
C. Kellogg	133	Beltsville - U.S.A.
Mrs. Kellogg	134	Beltsville - U.S.A.
D. King	227	Harpenden - Gr. Br.
A. Klemme	297	Columbia - U.S.A.
Mrs. and Miss Klemme	298	Columbia - U.S.A.
F. Koehler	281	Columbia - U.S.A.
J. Log	338	Norge
A. Leahey	234	Ottawa - Canada
J. Lehr	390	Wageningen - Nederland
J. Focan		Bruxelles
E. Letelier	262	Aberdeen - Gr. Br.
R. Lincoln	413	Mauritius
A. Low	247	Bracknell - Gr. Br.
G. Manil	458	Gembloux
L. Mannion	469	Dublin-Eyre
W. Martin	217	South Africa
W. Mitchell	181	Harpenden - Gr. Br.

GROUP B.

P. Nye	140	Great Britain
S. Obenshain	335	Blacksburg - U.S.A.
D. Osmond	182	Harpenden - Gr. Br.
M. Ozuygur	487	Turkey
L. Pons	162	Wageningen - Nederland
E. Reinau	223	Baden - Deutschland
L. Richards	324	Riverside - U.S.A.
Mrs. Richards	325	Riverside - U.S.A.
D. Ryan	470	Ireland
A. Shaikh	537	Pakistan
J. Schelling	94	Zwolle - Nederland
G. Semb	401	Norge
A. Smith	123	Edinburgh - Gr. Br.
G. Steur	455	Wageningen - Nederland
R. Tavernier	402	Ghent, Belgium
J. Taylor	307	Australia
N. Taylor	416	New-Sealand
J. Thorp	145	Lincoln - U.S.A.
Mrs. Thorp	146	Lincoln - U.S.A.
Miss E. Tibbetts	139	Berkeley - U.S.A.
M. Timonin	263	Ottawa - Canada
D. Van Diepen	78	Boxtel - Nederland
R. Van der Schans	95	Wageningen - Nederland
Z. Van Doorn	422	Utrecht - Nederland
W. Van Liere	479	Wageningen - Nederland
H. Van Olphen	98	Amsterdam - Nederland
B. Vovk	371	Yougoslavia
J. Vuorinen	176	Finland
T. Walsh	460	Dublin - Eyre
A. Wiggers	10a	Groningen - Nederland
A. Wild	226	Reading - Gr. Br.

TIME-TABLE

MONDAY, AUGUST 14th.

Morning : Programme for both groups : visit to the State Agricultural Institute-Ghent.

- 9.00 a.m. : Departure from the hotel « Cour St. Georges » by bus for the State Agricultural Institute, Coupure, 233, Ghent.
- 9.15 a.m. : Reception at the Feast-Hall (room n^r 27, groundfloor) by the rector, Prof. Dr J. Van de Brande and by Prof. Dr L. De Leenheer.
- 9.30 a.m. : Opportunity to pay the excursion fee and to exchange foreign currency, in room n^r 68, groundfloor.
- 10.00 a.m. : Visit to the exposition of the methods and results of the soil survey in Belgium, as carried out under the auspices of the I.R.S.I.A.
Free visit to the laboratoria. Explanation will be given in a booklet and by the respective professors.
Tea will be offered in room n^r 157, first floor.
- 11.45 a.m. : Departure from the State Agricultural Institute by bus to the hotel.
- 12.00 a.m. : Lunch at the hotel.

Afternoon : Programme for the separate groups :

GROUP A :

- 2.30 p.m. : Departure from the hotel by bus for excursion to the Ghent-district.
- 6.00 p.m. : Return to the hotel.

GROUP B :

2.00 p.m. : Departure from the hotel by bus for excursion to the « Land of Waas ».

6.00 p.m. : Return to the hotel.

For both groups :

7.00 p.m. : Dinner at the hotel « Cour St. Georges ».

The big stores are closed at 6.00 p.m.; the smaller shops are generally opened till 8.00 p.m. Tuesday, 15th, most shops will be closed.

TUESDAY, AUGUST 15th.

Members of both groups will be provided with a lunch packet, furnished by the hotel.

Programmes for the separate groups :

GROUP A :

9.00 a.m. : Departure from the hotel by bus for excursion to the « Land of Aalst ».

9.45 a.m. : Excursion « Land of Aalst » (Meldert).

11.45 a.m. : Departure for St. Niklaas.

0.30 p.m. : Lunch at the Agricultural School at St. Niklaas.

2.00 p.m. : Excursion to the « Land of Waas ».

5.00 p.m. : Departure for Louvain.

7.00 p.m. : Arrival at Louvain.

GROUP B :

9.00 a.m. : Departure from the hotel by bus for excursion to the Ghent-district.

0.30 p.m. : Departure for Aalst (Hekelgem).

1.00 p.m. : Lunch at Hekelgem.

2.30 p.m. : Excursion to the « Land of Aalst » (Meldert).

5.00 p.m. : Departure for Louvain.

6.30 p.m. : Arrival at Louvain.

EXCURSIEKAART - GENTSE EXCURSIES OP 14-15 AUGUSTUS 1950

Map of the Ghent-excursions August 14-15 1950

VERKLARING

EXPLANATION

— RIVIEREN - Rivers

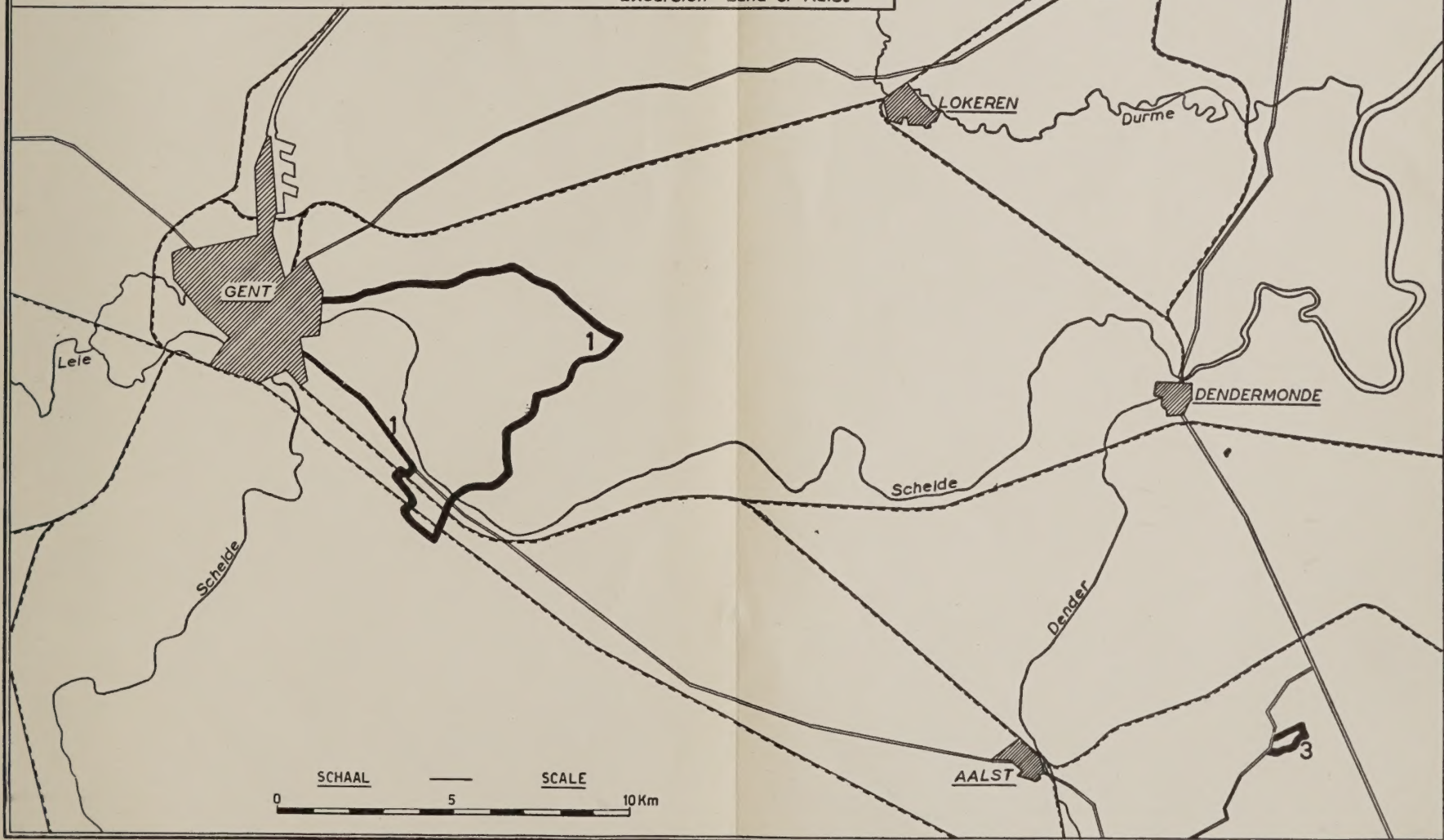
— 1 EXCURSIE OMGEVING GENT
Excursion Ghent-area

--- SPOORLUNEN - Railroads

— 2 EXCURSIE LAND VAN WAAS
Excursion Land of Waas

— HOOFDWEGEN - Principal roads

— 3 EXCURSIE LAND VAN AALST
Excursion Land of Aalst



1. EXCURSION IN THE ENVIRONS OF GHENT

Subject : A few aspects of the water-economy in sandy soils.

Literature : G. SCHMOOK : « De bodemkartering van het gebied van Gent en omgeving ». Natuurwetenschappelijk tijdschrift 31 pp. 103-110, Gent 1949.

F. SNACKEN en F. R. MOORMANN : « Over de bodemgesteldheid van de Zandstreek ». Comptes rendus des recherches de l'I.R.S.I.A., Bruxelles 1950.

Appendix : General soil-map of the area in the East of Ghent, marking the excursion itinerary.

Legend : A. The alluvial plain of the Scheldt.

1. Riverridge soils.
2. Basin soils.
3. Alluvium-covered pleistocene soils.

B. The sandy region of Flanders.

4. Homogeneous sandy soils.
5. Sandy soils with loamy subsoil.
6. Fine sandy soils.
7. Colluvial soils.
8. Dune soils.
9. Pleistocene-covered tertiary soils.

10. Artificial soils.

Technical Data :

The first excursion group (August 14th, 2.30-6.00 p.m.) is placed under the guidance of F. R. MOORMANN and R. MARECHAL, the second one (August 15th, 9.00-12.30 a.m.) under the guidance of F. R. MOORMANN and G. T'JONCK.

EXCURSION PROGRAMME.

1. Description of the area.

a) Topography:

The mapped area surrounding the town of Ghent is situated for the greater part in the sandy region; part of it belongs to the alluvial plain of the Scheldt, whereas in the south-eastern part we come upon the transition area, between the sandy soils and the sandy-loam soils. The sandy region, situated from 6 to 16 meters above the sea-level, shows a slightly undulating relief (micro-relief).

On the northern side of the annexed map (fig. 1) we find the more elevated tracts running more or less W. E. In the southern part, the level country is interspersed by lower patches of land of capricious sizes and shapes. The highest of all are those areas where older tertiary formations appear near the surface, and the dune areas. The transition area towards the sandy-loam region shows a more undulating relief; differences in height from 15 to 20 meters occur at rather short distances from each other.

The alluvial plain of the Scheldt lies about 5 meters above the sea-level and constitutes the lowest part of the surveyed area.

b) Origin:

During the latest glacial age (Würm) a layer of cover-sand of varying thickness (niveo-eolian sand) was deposited on an undulating substratum formed by tertiary formations. In the course of the Post-glacial age, the rivers cut deep valleys, whence sand was blown up which settled on the cover-sand, thus locally forming dunes (eolian sand).

The river-valleys were later on filled up, especially with terrigene materials, but locally also with peat.

On the cover-sand soils, a forest-vegetation developed during the Holocene whence brown forest-soils came into being. The highest parts of the landscape were cultivated, but later on again they were temporarily abandoned. On these fallow soils a heather vegetation developed which was probably kept up by sheep-farming. This heather vegetation caused the brown forest-soils to degenerate into heather podsollic soils. Later still practically the whole of the landscape was cultivated.

Owing to the washing away of minute particles of the higher areas, the low-lying parts were then mostly covered by a layer of loamy colluvium.

c) Nature of the soils:

In the alluvial plain of the Scheldt the soils are composed of:

- alluvial sediments of the Scheldt: these sediments are mainly brown and grey clay; along the river lighter materials are also found.
- peat: the peat met with here is mostly soiled by terrigenous materials.
- pleistocene: the pleistocene material often met with under the alluvial sediments is generally sandy; locally loamy pleistocene is found.

In the sandy region the soils are constituted from:

- colluvial loamy sand or sandy loam: the colluvial material is brown humiferous and sometimes calcareous; it is found only in low-lying plots.
- eolian sand: the eolian sand of this region shows normally the following mechanical composition:

sieve-openings <	0.053	0.053	0.074	0.104	0.147	0.208	0.295 mm.
weight %	2.42	3.50	10.63	26.62	37.60	17.34	2.56

The fraction less than $20\ \mu$ is very small or altogether absent. Sand which is not humiferous is of white grey colour.

Eolian sand is especially met with along the alluvial plain of the Scheldt.

- Peat or peaty material: it is locally found in small hollows.
- Cover-sand: normally the cover-sand of this region has the following mechanical composition:

sieve-openings <	0.053	0.053	0.074	0.104	0.147	0.208	0.295 mm.
weight %	8.80	7.20	16.80	30.40	32.70	3.60	0.50

In the transition area to the sandy-loam region it is of a finer texture:

sieve-openings <	0.053	0.053	0.074	0.104	0.147	0.208	0.295 mm.
weight %	50.70	13.10	15.70	14.50	4.90	1.10	—

Fraction 20 — 53 μ : 40.82%.

Fraction 0 — 20 μ : 9.88%.

Beneath the coarse or the fine cover-sand we find mostly more loamy materials which are sometimes calcareous(1)

fractions	0-2	2-20	20-50	50-100	100-200	> 200 μ
weight %	17.8	10.1	39.1	16.7	14.9	1.4
Contents free CaCO_3 =0,5%.						

The non-humiforous cover-sand is yellowish grey to light grey. The soils of the sandy region are principally built up of cover-sand.

- Tertiary sediments: these sediments vary, in the here mapped region, from coarse sand to very heavy plastic clay. They are only found locally at less than 125 cms depth.

The various soil-types of the mapped region are grouped as follows:

A. The alluvial plain of the Scheldt.

River ridge soils: they are mainly composed of brown alluvial clay, locally also of coarser alluvial sediments.

(1) Mechanical analysis executed by the Centre for Soil-Research.
Director Prof. L. DE LEENHEER.

Basin soils: heavy grey alluvial clay, resting on peat at varying depths.

Covered pleistocene soils: heavy, alluvial clay, sometimes blended with sand, resting on cover-sand or eolian sand.

B. The sandy region around Ghent.

Homogeneous sandy soils: more than 80 cms sand (coarse cover-sand or eolian sand).

Different soil-types are distinguished, according to the colour of the top humiferous horizons and according to the depth of the rust-speckled horizon.

Sandy soils with loamy or sandy loam subsoil: 40-80 cms sand, passing into loamy sand. Soil-types are distinguishable according to the depth at which rust specks appear.

Fine-sandy soils; this group which, by further charting should be subdivided, comprises besides homogeneous fine-sandy soils, also fine-sandy soils with a loamy subsoil.

Colluvial soils: more than 30 cms sandy-loam-to loamy colluvium resting on cover-sand (sandy or loamy). Soil-types are distinguishable according to the texture and the colour of the colluvial material.

Dune soils: more than 100 cms eolian sand; the profiles are situated on high, strongly undulating areas.

Covered tertiary soils: sand or fine sand at less than 120 cms depth lying on tertiary sediments. Soil types are distinguishable according to the depth of the rust specks and according to the texture and the depth of the tertiary materials.

Artificial soils: among the latter we count the profiles which by the interference of man, changed so much that the original profile-structure is no longer recognizable.

d) Short agricultural characterisation:

Riverridge soils: on these soils crops may successfully be grown. Sometimes, however, riverridge soils are too wet.

Basin soils: on account of their low-lying situation these soils are only fit for extensive meadows (hay-fields).

Covered pleistocene soils: the types of this series are generally used as meadows; only on the high types crops may be grown successfully.

Homogeneous sandy soils: the dry homogeneous sandy soils are suitable only for less requiring agricultural plants. They are the best soils for floriculture.

The wet types of this series are generally used as meadows. The growing of crops is here speculative, as these soils are periodically too wet. The soils with a brown-humiferous top-soil are agriculturally far superior to those with a grey-humiferous top-soil.

Sandy soils with a sandy-loam or a loamy subsoil: the soil-types of this series have a higher agricultural value than the types of the preceding series. They are, however, not fit for floriculture. The wet types are used as grassland.

Fine sandy soils with or without a loamy subsoil: the value of these soil-types is higher than that of the coarser sandy soils. Beetroots and wheat may successfully be grown on the medium dry types. These soils are less suitable for floriculture.

Colluvial soils: they are the best agricultural soils of the sandy region. Beetroots and wheat yield good crops. These soils are however very often too wet because of bad draining.

Dune soils: they have but a very poor agricultural value; they are mostly covered with heath or wood.

Covered tertiary soils: they differ greatly in quality but they generally produce higher yields than the dry homogeneous sandy soils. These soils are less suitable to floriculture.

2. The excursion.

The excursion follows the way from Ghent to Dendermonde up to the excursion point 1. The village of Destelbergen is a typical example of an elongated agglomeration on a higher almost West-East running sand-ridge. Past Destelbergen the road crosses a typical sandy landscape with hedge enclosures around the high-lying plots and pollardwillows and poplars around the lower plots.

Point 1: Laarne, along the main road Ghent-Zele.

a) Profile of a dry homogeneous sandy soil: medium poor agricultural soil (rye) (1).

- 0-22 : top-soil: sand, brown-grey, humiforous, many roots.
- 22-40 : sand, light brown-grey, less humiforous, many roots.
- 40-60 : sand, light-grey, with many bleached grains, less roots (remnant of a A2 horizon).
- 60-90 : sand, cloudy dark grey-brown, browner lower down, rust specks (B1 - B2 horizon), fewer root-traces.
- 90-120 : sand, getting rapidly lighter lower down, few rust specks.
- 120 : loamy sand, cloudy white-grey, rather compact, distinct rust specks.

This profile is a typical example of the dry sandy soils of the region. The presence of a fossil heather podsol profile, proves that no damage was caused here by wind erosion (neither flying up or blowing off). In regions

(1) These profiles were described by the Centre for Soil-Research Prof. DE LEENHEER.

where no hedge fences are to be seen, the same kinds of sandy soils are seriously damaged by wind erosion.

b) Profile of a colluvial soil (brown, loamy-sand soil) of high agricultural value (wheat, beetroot) :

- 0-22 : top-soil : light loamy sand, brown humiferous, many roots (colluvial material).
 22-40 : light loamy sand, brown, humiferous, many roots, few rust specks (colluvial material).
 40-70 : loamy sand, pale-brown, fewer roots and root-traces, numerous rust specks.
 70-106 : sandy loam, cloudy pale-grey, few root-traces, numerous rust specks, calcareous.
 106-114 : sandy loam, reddish, few root-traces, little calcareous.
 114- : sand, containing some loam, grey, few rust specks.

This profile which lies but about 80 cms lower than the foregoing, has a much higher agricultural value, especially because the materials have a higher water retaining capacity. During the winter, a surcharge of water may occur.

After point 1 the excursion follows some secondary roads which are generally situated on high sandy soils. The village of Laarne, which we pass by, is situated on a tertiary hill. This village shows a more compact agglomeration. Near the village of Melle the road crosses the Scheldt valley. Beyond this village, the landscape is becoming more rolling: the transition area between the sandy region and the sandy-loam region.

Point 2. Melle-Kouter.

Transition from the homogeneous sandy soils to the fine-sandy soils with loamy subsoil.

a) Profile of a dry homogeneous sandy soil with brown top-soil. Medium poor agricultural soil (rye).

- 0-19 : top-soil : sand, dark brown, many roots.
 19-45 : sand, brown to light-brown, little humiferous, many roots.
 45-94 : sand, white-grey, fewer roots and root-traces, a few rust specks at more than 60 cms depth.
 95-130 : sand, locally a little loamy, grey, few roots and root-traces, more rust specks.

*Sandy gray-
Brown Podzolic*

This profile is drying up fast in summer. The brown humus has however a higher water retaining capacity than the grey humus of profile Ia.

b) Profile of a fine-sandy soil with loamy subsoil. Good agricultural soil (rye and wheat soil, also suitable to beetroots).

- 0-36 : top-soil : fine sand, dark brown, humiforous, many roots.
- 36-45 : fine sand, brown, many roots.
- 54-74 : loamy sand to sandy loam, brown, a little plastic, compact structure, few roots, many rust specks.
- 74-84 : sand, not very loamy, white-grey, few roots, few small rust specks.
- 84-120 : loamy sand, somewhat reddish, few roots.
- 120- : sandy loam, grey-brown, plastic; crumb structure, numerous rust specks. At greater depth the material is mixed with tertiary glauconitic greenish sand.

Though the profile « b » is lying higher, the water-economy of this profile is much more favourable. This is accounted for by the fact that the loamy material of profile « b » has a great water-retaining capacity; it is also due to the better development of the humiferous horizons.

Point 3 : The oldest centre of the floriculture in the vicinity of Ghent.

In so far the floriculture is carried on in artificial soils (pot culture, hothouses) it is independent of the nature of the soil. Open ground culture of begonia and azalea, however, needs homogeneous sandy soils, as these plants have no optimum growth when the water table lies high and when there is a (loamy) disturbance in the profile. These cultures depend on sprinkle-irrigation for their watersupply. The quality of this irrigation-water is of great importance (salt percentage). In the visited region the water is derived from tertiary formations which may contain nocuous salts, with the result that a failure in the culture often occurs. Especially on account of a lack of sufficiently good soils for floriculture, but also because

of the lesser quality of the irrigation-water, the region of Melle-Merelbeke seems unfit to the further development of floriculture. There is even a general tendency toward displacement of this flower-region to the high sandy soils in the North-East of Ghent, where sufficient good flower-soils and good irrigation-water are available.

a) Profile of a dry homogeneous sandy soil with artificially enriched humiferous top-soil. Medium poor agricultural soil; good flower soil. Failures occur in dry summers, because the irrigation-water is of inferior quality.

0-30 : top-soil : sand, black-grey humiferous (enrichment by means of fir litter), bleached grains.

30-44 : sand, cloudy greyish brown.

44-73 : sand, greyish, rust specks.

73-91 : sand, yellow-grey, rust specks.

91-110 : sand, yellow-grey to grey, many rust specks and concretions. Groundwater-table.

2. EXCURSION « LAND OF WAAS »

Subject : Man made soils.

- Literature :** 1. F. SNACKEN & F. R. MOORMANN :
« Over de Bodemgesteldheid van de
Zandstreek ». Comptes rendus des re-
cherches de l'I.R.S.I.A., Bruxelles, 1950.
2. F. SNACKEN : « De Bodemkartering
van Lokeren ». Natuurw. Tijdschr. Jrg.
31, pp. 110-115 — Gent 1949.

Appendix :

Fig. 2 : General soil map of the Land of Waas, with ex-
cursion route (scale 1/100.000).

Fig. 3 : Detailed soil map of St. Pauwels and environs
(scale 1/10.000).

Fig. 4 : Schematic cross-sections through « rounded
fields ».

Technical data :

Both groups (Group B, August 14th, 2.00-6.00 p.m. and
group A, August 15th, 2.00-5.00 p.m.) will be guided by
F. SNACKEN and G. T'JONCK.

General information :

The « Land of Waas » is a part of the sandy region.
For the description of the origin of the landscape there
can be referred to the programme of the excursion in the
Ghent-district.

A most distinctive feature of the Land of Waas is the
presence of fields with a convex surface (« rounded
fields»), surrounded by ditches, planted with poplar-
trees, making it look like a park landscape. The level dif-
ference between the center and the border of the roun-
ded fields is of the order of 150 cms.

More than in any other part of the sandy region, the profiles have been greatly modified by the interference of man.

Agriculture there is practised so intensively as to become nearly gardening. This is the reason why this region is often called the « Garden of Flanders ».

EXCURSION PROGRAMME.

Point 1. — Waasmunster.

In many spots of this common the originally sandy soils have been improved by mixing the top-soil with altered tertiary clay, which was dug out especially for that purpose. Two profiles are demonstrated in succession, a first showing a natural soil and a second more or less modified by mixing with clay.

a. Natural sandy profile :

0-60 cms : grey-brown sand, poor in humus-contents.

60-120 cms : pale-yellow sand, with a few rust specks, becoming more frequent in the lower part of the profile.

120 cms : thin layer of quartz and altered flint (base of the pleistocene formations), resting on tertiary clay.

This soil has but a mediocre agricultural value.

b. Artificial profile resulting from the thorough mixture of clay and surface sand.

irregular
0-60 cms : clayey sand, brown-yellow, relatively homogeneous, and poor in humus-contents. Quartz and silex pebbles are found, often altered.

60-120 cms : pale-yellow homogeneous sand, showing ~~no~~ signs of artificial disturbance.

120 cms : altered, tertiary clay in situ.

It is due to the thorough mixture of the clay with the sand that this profile, originally of a very low agricultural value, became suited to the culture of wheat and beet-roots.

Point 2. — St. Pauwels — Several profiles in a « rounded field » (fig. 4a).

a. Profile on the top of the field :

- 0-65 cms : grey-brownish sand, humiferous; small quartz and silex pebbles; fragments of bricks and ashes are frequently met with, sometimes also squal-teeth.
- 65-75 cms : dark grey-brownish sand, very humiferous.
- 75-80 cms : blackish sand, very humiferous (horizon Ao).
- 80-90 cms : whitish-grey sand (horizon Al).
- 90-100 cms : brownish-black sand rather humiferous (horizon Bl).
- 100-120 cms : ferruginous reddish-brown sand, firmed and forming a layer of compact and impermeable hard-pan.
- 120-150 cms : pale-yellow sand with rust-specks of light brown colour.

Between 75 and 150 cms of depth the profile is not disturbed and corresponds to an ancient heather-profile (podsol).

b. Profile situated between the centre and border of the plot.

- 0-60 cms : grey-brownish sand, humiferous, with few small pebbles of quartz and silex.
- 60-65 cms : chocolate-brown sand, rather compact.
- 65-80 cms : compact hard-pan.
- 80-100 cms : yellow sand with rust specks.
- 100-150 cms : slightly loamy sand. The loam presents itself in narrow, horizontal strips, 2 till 5 cms thick on the average. In the lower part, the frequency of these loamy levels diminishes rapidly.

The profile is not disturbed and corresponds with the horizon B2 of an old heather-profile (podsol), the upper part having been disturbed by intense labour.

c. Profile situated along the border of the field.

- 0-80 cms : grey-brownish sand, humiferous, disturbed.
- 80-120 cms : pale yellow sand, with rust specks, with thin layers of loam.

In the lower parts the sandy layers become thicker and thicker and the material coarser.

Point 3. — St. Niklaas — Brick-yard S.V.K.

Cross-section through rounded fields (Fig. 4b).

The exposure of a 120 m breath and a medium depth of 4 m, shows profiles similar to those at St. Pauwels. In the centre and on the slopes of the rounded fields we notice again traces of heather-profiles (podsol) covered by materials brought up by man. It can also be observed that the ditches bordering the plots correspond to old channels, for the greater part filled up artificially, probably at a recent historical period (middle-ages).

On the border of the plots sometimes a calcareous accumulation layer is found. In some places it follows the sides of the filled up channels. Besides, the base of the channels often coincide with cryoturbative phenomena. Probably the channels have a natural origin, may be of the late glacial age. The materials which fill up the channels and the near by strips of land were used to cover and heighten the central parts of the plots.

The mapping of the rounded fields is very difficult because of these disturbances of the original profiles.

To get a general idea of the agricultural value of the rounded fields, all the observations were made mid-height between the top and the border of every field.

The degree of rounding has been noticed on a documentary map. Fig. 3 is a representative soil map of this region.

The agricultural value varies from field to field and even on the same field from one spot to another. On the same field the lower parts may suffer from an excess of humidity, while the centre may be too dry.

Often distinct crops are grown on one plot, as a result of adaptation of the varying moisture conditions of the soils.

Although sandy, the rounded fields of the Land of Waas are, in a general way, relatively fertile, and even suited to the culture of wheat and beetroots.

Once this region has been famous for its flax-growing.

3. EXCURSION « LAND OF AALST ».

Subject : The influence of hanging water tables on sandy-loam soils.

Literature : A. LOUIS : « De Bodemkartering van de gemeente Wieze ». Natuurwetenschappelijk Tijdschrift, T. XXXI pp. 116-119, 1 fig. Gent, 1949.

R. MARECHAL : « De Bodemkartering van het Land van Aalst ». Ibid., T. XXX, pp. 97-100, 1 fig. Gent, 1949.

J. VAN DAMME : « Een voorbeeld van nauwe samenwerking tussen Veld- en Laboratoriumonderzoek bij de Bodemkartering ». Ibid., T. XXXI, pp. 140-141, 1 fig. Gent, 1949.

Annexes : A detailed map of a part of the commons of Meldert and Baardegem, marking the points of the excursion.

Legend :

1. Sandy loam, resting on tertiary clay at less than 60 cms.
2. Sandy loam, resting on tertiary sand at less than 60 cms.
3. Sandy loam, resting on tertiary clay between 60 and 125 cms.
4. Sandy loam, resting on tertiary sand between 60 and 125 cms.
5. Sandy loam, more than 125 cms; rust specks beginning at more than 80 cms.
6. Sandy loam, more than 125 cms; rust specks beginning between 50 and 80 cms.
7. Sandy loam, more than 125 cms; rust specks beginning between 20 and 50 cms; situated at a low topographical level.

8. Sandy loam, more than 125 cms; rust specks beginning between 20 and 50 cms; situated at a high topographical level.
9. Sandy loam, more than 125 cms; rust specks beginning between 0 and 20 cms; situated at a low topographical level.
10. Sandy loam, more than 125 cms; rust specks beginning between 0 and 20 cms; situated at a high topographical level.
11. Buildings.

Technical data :

The first group (August 15th 9.45-11.45 a.m.) is placed under the direction of R. MARECHAL and F. R. MOORMANN, the second (August 14th 2.30-5.00 p.m.) under the direction of R. MARECHAL and F. SNACKEN.

EXCURSION PROGRAMME.

1. Description and genesis of the region.

The different points of this excursion are situated on a very limited area in the sandy-loam region of the South of Flanders. In the zone to be visited the landscape presents a rather marked relief, the topographical level varying between 30 and 70 m above sea-level.

The essential characteristics of this relief are determined by the nature of the geological substratum. This substratum is composed of a complex of subhorizontal layers, alternatively sandy or clayey. The clayey layers, more resisting to erosive action than the sandy layers, form the foundations of the different hills and slopes.

During the last glacial age (Würm) a sandy-loam cover was deposited on this substratum. On more abrupt slopes exposed to the West, this cover is generally rather thin. On table lands and in depressions on the contrary this cover may have a considerable thickness. The cover is composed on the one hand, of very fine elements of

eolian origin and on the other hand of tertiary sediments removed by creep and sheet erosion.

Due to the presence of impermeable layers in the tertiary subsoil there exist in that region perched water-tables. Consequently the wet soils are not located only in the hollow parts, but also on table-land and on slopes.

The sandy-loam materials of the wet profiles present numerous rust specks which are plainly seen on the greyish background.

2. Constitution of the soils.

In the sandy-loam region the soils are composed of :

- pleistocene coarse sediments of niveo-eolian origin; generally loam which becomes, at some depth, very sandy on account of the presence of removed tertiary sand. In moist sandy profiles, the humus has more often a greyish colour, whereas in dry profiles on the contrary, it has a brownish appearance.
- tertiary sediments : different layers especially composed of clay and sand; the most important of these layers being « Asse » clay (thickness about 12 m. Barton clay-Eocene). « Asse » clay is very heavy and very compact, with no structure and of a greenish or greyish-green colour, at times showing yellow spots on its surface, as a result of oxidation.

In the sandy-loam region, the types of soils are grouped in :

1. Sandy-loam soils of which the sandy-loam cover has a thickness superior to 125 cms. These grounds are divided according to their water-economy and, as regards wet soils, according to their topographical situation.
2. Covered tertiary soils where the sandy loam cover has a thickness inferior to 125 cms. The subdivision into

types is based on the thickness of the cover and on the nature of the tertiary substratum.

The sandy-loam soils which are not suffering from an excess of moisture, yield the best arable land. The covered soils, on the other hand, often have but a poor agricultural value.

3. The excursion.

The various points of the excursion are grouped in the vicinity of the hamlet called « De Berg » at the boundaries of Meldert and Baardegem.

a. Profile in a sandy-loam soil, situated at a low topographical level.

- 0 — 20 cms : top-soil; loam, dark grey, with many roots and many rust specks.
- 20 — 44 cms : coarse loam of dark grey colour, with numerous rust specks and veins.
- 44 — 65 cms : coarse loam, of greyish white colour with small rust specks, containing much removed tertiary sand.
- 65 — 95 cms : coarse grey-bluish loam, with but few rust specks; phreatic sheet.

The materials of this profile are of a rather coarse texture and of colluvionary origin. In these soils peaty materials are locally found at a certain depth. By their topographical situation these soils are wet all the year round.

b. Profile in a dry sandy-loam soil.

- 0 — 22 cms : top soil; coarse loam, dark brown, with good clotty structure and many roots; no rust specks.
- 22 — 35 cms : coarse loam, lighter than in the foregoing horizon, less humiferous, no rust specks.
- 35 — 92 cms : coarse loam, brown, with clotty structure and numerous traces of roots, rare traces of rust.

92 — 116 cms : coarse loam, light-brown, containing a certain fraction of removed sandy tertiary clay, which is rather heavy and plastic; less distinct rust specks.

116 — 150 cms : coarse clay, light-brown, more or less greyish, containing large quantities of removed tertiary sand and becoming the deeper the more sandy.

The latter profile is situated at a level slightly superior to the preceding one; it is homogeneous and humiferous down to a great depth. The absence of any distinct rust specks proves that on this profile an excess of wetness is never to be feared. On the other hand, water shortage is not to be feared either on such a soil, by reason of the very fine texture of the materials and the richness in organic materials. The presence of removed tertiary sand at some depth, does not seem to entail very unfavourable consequences.

This type of profile may be considered as the best of the sandy-loam region.

c. Profile on tertiary clay.

0 — 8 cms : top-soil, coarse loam mixed with removed tertiary clay, dark grey, nearly not humiferous, nearly not clotty, with many roots and numerous rust specks.

8 — 30 cms : heterogeneous materials (loam, sand, pebbles and clay) greyish, a little humiferous, with numerous rust specks.

30 — 150 cms : heavy clay, very compact, without structure, glauconitic, greenish, with yellow and grey spots.

This profile is found on a steep slope, where the presence of coppice wood and the meagre meadows testify of the poverty of the soil.

These profiles on tertiary clay have a very irregular water economy. They are very wet in winter and dry in

summer. That is why they are only cultivated with the greatest difficulty.

From this point onward, we have a general view on the morphology of the region. We descry a range of gently swelling hills (Boekhoutberg, Cravaalbos, Helderberg) whose foundations are formed of « Asse » clay, and which command a view on a depression, dug out in the sandy layers less resisting to erosion.

d. Profile in a wet sandy-loam soil, situated on a rather elevated topographical level.

- 0 — 28 cms : top-soil, coarse loam, dark grey with plenty of roots, not very clotty, traces of rust.
- 28 — 50 cms : coarse loam, grey, but little clotty, with a few light rust specks.
- 50 — 108 cms : coarse loam, grey, but a little clotty, rather compact with many large and distinct rust specks.
- 108 cms : coarse loam, grey, containing clay and especially removed tertiary sand; glauconous, with large rust specks.
In spring : watertable at 110 cms.

This profile is situated on the top of the plateau. The clay is no longer within reach of soundings, but remains however a cause of the irregularity in the hydrological regime of these soils.

Though very wet in winter, these soils may be very dry in summer.

The agronomical value of these soils is lessened by the fact, that the zone where they are situated has been reclaimed rather recently.

Patches of woodland or uncultivated plots are rather frequently met within this particular zone. Hay-meadows are also very typical.

BELGIAN COINS AND BANKNOTES

Frs.	0,05	5 centimes (coin : zinc or nickel)
	0,10	10 centimes (coin : zinc or nickel)
	0,25	25 centimes (coin : zinc or nickel)
	0,50	50 centimes (coin : nickel)
	1,00	1 franc (coin : zinc or nickel)
	2,00	2 francs (coin : zinc)
	5,00	5 francs (coin : zinc or nickel)
	20,00	20 francs (banknote or silver-coin)
	50,00	50 francs (banknote or silver-coin)
	100,00	100 francs (banknote or silver-coin)
	500,00	500 francs (banknote)
	1.000,00	1.000 francs (banknote)
	10.000,00	10.000 francs (banknote)

POSTAL RATES

	For abroad	Belgian Congo	The Netherlands
Letters			
0-20 grammes	frs. 4,00	frs. 3,00	frs. 1,75
per 20 grammes			
more	frs. 2,50	frs. 1,25	frs. 1,75
Postcards	frs. 2,50	frs. 1,20	frs. 0,90

AIR MAIL

Air-fee in addition to ordinary postage for the following destinations :

Europe : Germany, France, United Kingdom : no additional air-fee. The other countries : frs. 1,00 per 20 grammes.

Per 5 grammes :

South America : frs. 6,50

North America : frs. 2,50

Central America : frs. 4,00

Africa : Algeria, Maroc, Tunis frs. 1,00

Belgian Congo, French equatorial

Africa frs. 3,00

Other countries frs. 4,00

Asia : Turkey, Arabian Peninsula	frs. 2,00
Burma, India, Pakistan	frs. 5,00
Indonesia	frs. 7,00
Australia and New Sealand	frs. 10,00

CONVERSION TABLE

1 cm	0.3937 inch
1 m=100 cm	3.28 feet=1.094 yard
1 km=1000 m	0.621 mile
1 inch	0.0254 m
1 foot (12 inches)	0.305 m
1 yard (3 feet)	0.914 m
1 chain	20 m
1 mile	1.609.3 m
1 ha=100×100 m	2.47 acres
1 acre=10 sq chains	0.405 ha
1 gallon (Imperial)	4.55 l=1.2 Am. gallons
1 bushel (Imperial)	36.35 l=1.032 Am. bushels
1 kg	2.204 lbs
1 lb (pound avoirdupois)	0.453 kg
1 cwt (hundred weight)	50.8 kg=112 lbs
1 (metric) quintal (q)	100 kg=220.5 lbs
1 doppelzenter (dz)	100 kg=220.5 lbs
1 short ton	2000 lbs=907 kg
1 metric ton	2205 lbs=1000 kg
1 long ton	2240 lbs=1016 kg
1 bushel per acre	0.9 hl per ha
1 lb per acre	1.12 kg per ha
1 cwt per acre	125.6 kg per ha
1 q per ha	89.2 lbs per acre

SCALE OF SOILMAPS

1 : 5.000	approximately	12	inches to a mile
1 : 10.000	»	6	» » » »
1 : 20.000	»	3	» » » »
1 : 40.000	»	1,5	» » » »

②

**QUATRIÈME CONGRÈS INTERNATIONAL
DE LA SCIENCE DU SOL
1950**

**APERÇU SUR LA GÉOLOGIE ET LA
GÉOGRAPHIE PHYSIQUE DE LA BELGIQUE**

Outline of the Geology and
Physiography of Belgium

par Prof. P. MACAR
Université de Liège

Erratum

Page 1, l. Généralités, règle 7,
lire: correspond à la frontière
avec la France; le plus petit côté
du triangle se trouve à l'E
et forme frontière avec l'Alle-
magne,.....

APERÇU SUR LA GEOLOGIE ET LA GEOGRAPHIE PHYSIQUE DE LA BELGIQUE

(Outline of the Geology and Physiography of Belgium)

by Prof. P. MACAR,
University of Liège

1. Généralités

La Belgique (fig.1) occupe dans l'Europe nord-occidentale, à hauteur du 50^e parallèle, un territoire restreint qui peut être comparé grosso-modo à un triangle. L'hypothénuse de ce triangle, située au SW, s'allonge sur 300 km environ et correspond à la frontière avec l'Allemagne, le Grand Duché de Luxembourg et une petite partie de la Hollande; enfin, le dernier côté, situé au nord, correspond essentiellement à la frontière hollandaise et, à l'ouest, se prolonge par un lambeau de littoral, long de 70 km et orienté du SW au NE.

Au point de vue du relief, la Belgique est souvent comparée à un toit à versants inégaux: en gros, le sol s'élève peu à peu depuis le littoral jusqu'à une large zone culminante, orientée du SW au NE, dont les sommets atteignent de 500 à 700 m d'altitude, puis redescend, dans le coin SE du pays, jusqu'à des altitudes moyennes d'environ 350 m. Les plus hautes altitudes (point culminant: 694 m) se rencontrent à l'extrémité de la ligne de faite, près de la frontière allemande (Massif

de la Baraque Michel). Bien qu'ayant un relief déjà plus marqué que la Hollande, la Belgique est exclusivement une région de plaines et de plateaux, ces derniers plus ou moins découpés par l'érosion.

On distingue traditionnellement, dans ce relief, trois zones qui découpent le pays en bandes subparallèles à peu près EW. Au nord, la Basse Belgique est essentiellement une région de pleine, d'altitude inférieure à 50 m, qui est limitée en gros par un parallèle passant un peu au nord de Bruxelles. Au centre, la Moyenne Belgique est constituée de bas plateaux, situés entre la zone précédente et l'axe hydrographique formé par des vallées de la Sambre et de la Meuse entre Namur et Visé, axe qui traverse le pays de part en part. L'altitude, qui s'élève progressivement vers le sud, y est essentiellement comprise à la surface des plateaux, entre 50 et 200 m. Enfin, la Haute Belgique, située au sud de l'axe Sambre-Meuse, comporte divers plateaux d'altitude supérieure à 200 m. Un haut plateau bombé, l'Ardenne, à sommets supérieurs à 400 m, en occupe la zone centrale. Il est flanqué au nord par des plateaux moins élevés, à pente générale vers le NW, qui se raccordent, par delà le sillon Sambre-Meuse, à ceux de Moyenne Belgique. Enfin, au SE de l'Ardenne et du Pays, des reliefs moins élevés forment la Lorraine belge.

Pays de relief peu élevé, à double pente générale, et constituée d'une série de plaines et de plateaux, telle est donc la façon dont, en premiè-

re analyse, se présente La Belgique.

La structure géologique du sous-sol est en relation avec ce relief, qu'elle permet d'expliquer en bonne partie. La Belgique voit affleurer presque uniquement des roches sédimentaires, pour la plupart d'origine marine, et dont l'âge s'étend du Cambrien à l'Holocène. On y distingue un substratum, formé de roches résistantes, cohérentes et très généralement plissées, datant du Paléozoïque, et une couverture de terrains post-primaires, meubles ou peu cohérents et subhorizontaux ou à pente faible. Le substratum ou socle paléozoïque affleure essentiellement en Haute Belgique. La couverture le recouvre au nord, en Basse et Moyenne Belgique, ainsi qu'à l'extrême sud, en Lorraine belge. Trois zones apparaissent ainsi, et l'ensemble représente une vieille ride de l'écorce terrestre, usée et à demi enfouie sur ses deux flancs sous des sédiments plus récents. Au nord, ces derniers s'étendent largement sur une surface à faible pente; ils sont constitués essentiellement de craies du Crétacé, recouvertes de Tertiaire et de Quaternaire argilo-sableux. Au sud, la pente du substratum, plus raide, atteint quelques degrés (vers le sud) et la couverture, pareillement inclinée, est formée de Trias et de Jurassique, ce dernier comportant quelques niveaux plus durs qui forment cuestas. La ride elle-même date de l'orogénèse hercynienne; elle fut, depuis, pénéplanée, puis a été soulevée et en partie érodée à plusieurs reprises, les derniers mouvements ayant déterminé le relief actuel.

Les trois zones précédentes correspondent aussi à trois grandes provinces géomorphologiques distinctes: le glacis nord est une fraction de la Grande Plaine Baltique, qui du Pas-de-Calais aux Etats Baltes, forme une plaine côtière en bordure de la mer du Nord et de la Baltique; la Lorraine belge se rattache au Bassin de Paris, et constitue un fragment de son extrémité nord-est; le massif plissé, communément dénommé l'Ardenne, par extension du nom de sa partie principale, constitue avec la région allemande voisine de l'Eifel un des principaux massifs hercyniens du NW de l'Europe.

Nous venons de définir les traits tout-à-fait essentiels du relief, de la géologie et de la géomorphologie de la Belgique. De ces traits dépendent aussi, en grande partie, le climat et l'hydrographie du pays. Les chapitres suivants donnent un bref aperçu de ces derniers et reprennent ensuite, avec un peu plus de détail, l'histoire géologique et géomorphologique du territoire.

2. Le Climat de la Belgique

Traversée par le 50e parallèle, et située toute entière à peu de distance de la mer, la Belgique jouit d'un climat tempéré à saison froide, et essentiellement maritime. D'un bout à l'autre du pays, les différences climatiques sont peu importantes, et dues essentiellement au relief, qui provoque, de la mer vers les hauts sommets de l'Ardenne, une dimi-

nution de la température vraie et une augmentation notable des précipitations.

La température moyenne annuelle est voisine de 10° C en Basse et Moyenne Belgique; elle descend jusqu'à moins de 7° sur la ligne de faite du pays, pour remonter à plus de 8° dans la Lorraine belge. L'amplitude annuelle de température (différence entre les températures moyennes des mois le plus chaud et le plus froid) atteint 14° à Bruxelles; elle n'est que de 13° au littoral et s'élève à 15° dans le massif culminant de la Baraque Michel. Ceci amène en janvier, au nord du sillon Sambre-Meuse, des températures moyennes de l'ordre de 3° qui descendent jusqu'à $- 0^{\circ}5$ à la Baraque Michel; en juillet, par contre, les valeurs correspondantes sont respectivement de 17° et $14^{\circ}5$.

Mais ces valeurs constituent elles-mêmes des moyennes, dont les températures réelles s'écartent souvent beaucoup. En juillet, les maxima moyens de la température atteignent 31° dans le nord du pays; en janvier les minima moyens descendent jusqu'à $- 12^{\circ}$ dans la partie est de la ligne de faite. L'écart entre ces valeurs et les moyennes mensuelles donnent une idée de l'instabilité de la température.

Les variations de celle-ci, comme d'autre part les précipitations, sont essentiellement déterminées par

le passage des grandes dépressions barométriques caractéristiques de nos latitudes, et amenées par la prédominance des vents d'ouest. Ces dépressions amènent des périodes de temps instable et pluvieux, qui prédominent largement pendant toute l'année dans notre climat.

On observe en outre, de temps à autre, des périodes de ciel serein et de beau temps, chaud en été, souvent très froid en hiver; elles correspondent d'ordinaire à l'extension jusqu'à nos régions d'un large régime anticyclonique, stable et presque stationnaire, qui écarte temporairement les trajectoires des dépressions habituelles.

Les pluies sont modérées. Elles tombent toute l'année et atteignent une valeur moyenne de 800 mm dans la Basse et Moyenne Belgique, pour s'élever graduellement avec l'altitude en Haute Belgique, jusqu'à atteindre 1300 et 1400 mm, sur les sommets les plus élevés. La Lorraine belge reçoit environ 1 m de pluie, la zone littorale 700 mm seulement. En Haute Belgique, on note des précipitations moindres à l'endroit des vallées principales (de la Meuse et de l'Ourthe) et des pluies plus abondantes, au contraire, à l'ouest du massif ardennais et sur le flanc sud-ouest de ce massif (vallée de la Semois). Ces dernières s'expliquent par le mouvement ascendant imposé par le relief aux vents de sud-ouest, qui sont les plus humides. On peut dire qu'il pleut en moyenne, en Belgique, un peu plus d'un

jour sur deux.

Les pluies se répartissent sur toute l'année. Février et mars sont en général les mois les moins pluvieux, tandis que les maxima s'observent le plus souvent en juillet et en octobre-novembre, mais minima et maxima sont peu accusés.

Les chutes de neige se produisent en moyenne 25 jours par an, répartis entre novembre et avril. Au littoral, ce chiffre est réduit au $\frac{1}{3}$, tandis qu'il est augmenté de moitié sur les hauts plateaux de l'Ardenne.

Les vents dominants sont ceux du SW; les vents soufflant de ce quadrant se présentent avec une fréquence de 40%. Un maximum secondaire peu important se présente en outre pour les vents en provenance du NE. Enfin, le ciel de notre pays est fréquemment couvert: la nébulosité moyenne est de l'ordre de 75%, et l'on compte, en moyenne, à l'observatoire d'Uccle, 205 jours de ciel tout à fait couvert, pour 42 jours seulement de ciel serein.

3. Le réseau hydrographique et ses origines

Les cours d'eau qui arrosent la Belgique se groupent essentiellement suivant 2 bassins; ceux de l'Escaut et de la Meuse, qui se jettent tous deux dans la mer du Nord. L'extrême ouest du pays est drainé par

un petit fleuve côtier, l'Yzer, célèbre par la résistance offerte par l'armée belge le long de ses rives inondées lors de la première guerre mondiale. A l'extrême sud-est, quelques rivières peu importantes sont des affluents de la Moselle, et dépendent donc du bassin du Rhin.

Les bassins de l'Escaut et de la Meuse se répartissent le territoire de façon curieuse: en gros, le premier correspond à la Basse et Moyenne Belgique, et le second à la Haute Belgique. L'axe hydrographique Sambre-Meuse, qui marque la limite entre ces deux régions, est très proche en effet de la limite entre les deux bassins, et la Meuse ne comporte, au nord de cet axe, que quelques affluents peu importants.

Au nord, le Bassin de l'Escaut est composé essentiellement d'une série de rivières grossièrement parallèles et à peu près également espacées: la Lys, l'Escaut (d'Audenaerde), la Dendre, la Senne, la Dyle (de Louvain), les deux Geete. Ces rivières coulent toutes à peu près SSW au NNE. Selon la théorie classique, ce réseau est né sur les dépôts aujourd'hui érodés de la mer pliocène, lors de la régression de cette mer, la dernière qui ait envahi la région. La localisation des rivières semble toutefois en relation avec des mouvements du sol, tandis que des dépôts caillouteux du Quaternaire auraient joué ensuite le rôle de niveaux résistants et provoqué des inversions de relief et des modifications du drainage.

Tous ces tronçons de rivière sont ensuite groupés à Rupelmonde en un seul tronc puissant, qui constitue l'Escaut d'Anvers, par l'intermédiaire de deux sillons hydrographiques orientés grossièrement est-ouest. Le sillon ouest est formé par le cours de l'Escaut entre Gand et Rupelmonde, le sillon est constitué successivement par le Démer, la Dyle de Malines et le Rupel. Ce sillon s'est formé au Quaternaire: son cours supérieur borde en effet le bas plateau de la Campine, couvert par une vaste terrasse quaternaire de la Meuse, et formant relief par suite de la protection offerte par les cailloutis de cette terrasse; et ce cours supérieur serait né, comme une Yazoo River, en bordure de cette terrasse. Le sillon est se prolongeait jadis jusqu'aux environs de Gand: on connaît, au nord de cette ville, une large dépression - la Vallée flamande - qui prolonge l'Escaut d'Audenaerde et forme un ancien cours inférieur de l'Escaut. Cette dépression est comblée de dépôts nivéo-éoliens datant de la dernière glaciation. C'est suite à ce colmatage que se produisit, lors de la transgression marine qui suivit la dernière glaciation, l'ouverture de l'Escaut d'Anvers et l'établissement du drainage actuel, avec renversement du sens d'écoulement dans la section de l'Escaut de Gand à Rupelmonde.

Peu avant son entrée en Belgique, l'Escaut reçoit une rivière - La Haine - qui coule presque entièrement dans notre pays, et dont la disposition particulière mérite une brève mention. Dirigée sensiblement est-

ouest, cette rivière coule en effet dans une large dépression qui correspond à un synclinal tertiaire, lui-même superposé à un synclinal secondaire, et l'origine tectonique de cette dépression paraît ainsi à peu près évidente.

Le réseau hydrographique de la Meuse est plus ancien que celui de l'Escaut. La dernière transgression marine ayant atteint le flanc nord de l'Ardenne date selon toute vraisemblance de l'Oligocène. Sur ces dépôts aujourd'hui fortement érodés, des rivières ont dû se former, à la poursuite du rivage en retraite. On attribue cette origine à une série de tronçons plus ou moins importants du réseau: l'Eau d'Heure, la Meuse de Dinant (entre Revin et Namur), la Lesse, le Hoyoux, l'Ourthe de Laroche, la Hoegne. Ces rivières coulent vers le N ou le NW, perpendiculairement à la direction d'allongement de l'Ardenne elle-même, et sont nettement surimposées sur les terrains plissés de la Haute-Belgique. Ces terrains comportent des zones tendres, le long desquelles se sont développées ensuite des rivières ou tronçons de rivières subséquentes, moins importantes que les précédentes. Dans les plateaux du Condroz et de l'Entre-Sambre-et-Meuse, qui, respectivement à l'est et à l'ouest de la Meuse de Dinant, sont compris entre l'Ardenne et l'axe Sambre-Meuse, les plis du substratum provoquent l'alternance répétée de couches dures et tendres. Aussi les tronçons subséquents y sont-ils nombreux, et ils y ont pro-

voqué, dans un relief appalachien typique, le développement d'un drainage en treillis bien caractérisé. L'axe Sambre-Meuse, qui coupe transversalement la Belgique, n'est pas sans analogie avec le sillon Démer-Dyle-Rupel, qui se prolongeait jadis jusqu'à Gand. Comme ce dernier il rassemble les eaux d'une série de rivières conséquentes, en coulant presque perpendiculairement à ces dernières. Le terme de rivière transséquente a été proposé pour un tel type de cours d'eau, que l'on suppose implicitement formé le long d'une déformation synclinale provoquant une série de captures. Le sillon Sambre-Meuse s'allonge perpendiculairement à la pente générale actuelle du relief, et se superpose, en gros, à un synclinal du substratum paléozoïque (le synclinal de Namur). L'influence tectonique de ce dernier a pu être directe, c'est-à-dire provoquant directement, par une accentuation récente, la formation de la rivière, ou indirecte, si l'accentuation, plus ancienne, a formé simplement une courbure synclinale à la base des dépôts de couverture. Au moment de l'enlèvement de ces dépôts, cette courbure aurait laissé une gouttière emplie de sédiments tendres au milieu des terrains beaucoup plus résistants du substratum, et permis la formation rapide à cet endroit d'une rivière subséquente. D'autres hypothèses encore ont été émises et le problème reste controversé.

L'étude des nombreuses terrasses de la Meuse a montré qu'au de-

là de Liège, cette rivière a subi des vicissitudes diverses. Jadis, elle obliquait vers l'est, peu en aval de Liège, pour se jeter dans le Rhin près d'Aix-la-Chapelle. Ensuite, elle s'est déplacée largement et, coulant vers le NW, a déposé une large terrasse qui forme actuellement, comme dit ci-dessus, le bas plateau de la Campine. Enfin, et seulement alors, elle a acquis son cours actuel. Les terrasses sont affectées de déformations et de failles et, comme dans la vallée du Rhin, hautes et basses terrasses se croisent plus au nord en Hollande.

Au nord du sillon Sambre-Meuse, plusieurs affluents (la Meuse, le Piéton, et d'autres) présentent une particularité curieuse: ils franchissent la ligne de crête groupant les points les plus élevés au nord du sillon, ligne très proche de ce dernier, et vont recueillir, au delà de cette ligne, les eaux d'une série de ruisseaux à pente plus ou moins vers le nord. Leur tracé présente donc une forme en point d'interrogation, le cours supérieur étant orienté plus ou moins en sens inverse du cours inférieur. Il s'agit d'affluents obséquents du sillon Sambre-Meuse, qui, profitant de leur niveau de base local proche et peu élevé, ont percé par érosion remontante la crête de partage originelle et capturé des têtes de tributaires du bassin de l'Escaut.

En Lorraine belge, enfin, le drainage est essentiellement sub-séquent. La rivière principale, la Semois, coule dans la dépression marginale de l'Ardenne, entre ce massif et la première des cuestas du Jurassique. Elle traverse ensuite obliquement le massif ardennais pour atteindre la Meuse. Ce cours inférieur, caractérisé par de beaux méandres, encaissés, dont plusieurs recoupés, semble correspondre à un ancien tracé sub-séquent. Il se serait développé à un stade antérieur dans la dépression marginale alors située plus au nord, et se serait ensuite encaissé sur place lors de la reprise d'érosion qui a suivi sa formation.

4. L'histoire géologique

L'histoire géologique de la Belgique débute à l'époque cambrienne. Les roches appartenant à cet étage sont essentiellement des quartzites, des phyllades et des quartzophyllades, en général fortement plissés. Ils affleurent surtout en deux dômes importants, le massif de Stavelot et le massif de Rocroi, ce dernier situé en majeure partie en Ardenne française. Ces deux massifs jalonnent la zone centrale de l'Anticlinorium de l'Ardenne, pli majeur du substratum qui correspond à la région naturelle du même nom.

En Moyenne Belgique, le substratum paléozoïque apparaît localement, sous les dépôts de la couverture, dans les vallées des principales rivières. On y retrouve des affleurements cambriens, qui correspondent à

la partie centrale d'un autre anticlinal majeur, l'anticlinal du Brabant. Presqu'entièrement caché sous les dépôts postpaléozoïques, ce dernier est assez bien connu par sondages, et l'on sait que le Cambrien y occupe, sous la couverture, une très large zone.

Le Silurien, constitué surtout de schistes, est connu uniquement suivant deux zones assez étroites. La première, formant le flanc sud de l'anticlinal du Brabant, affleure de façon plus ou moins discontinue dans les vallées de Moyenne Belgique. La seconde se localise au sud du sillon Sambre-Meuse et une mince bande continue dite "bande silurienne du Condroz". Cette bande passe latéralement, de part et d'autre, à deux importantes failles de charriage et est elle-même hachée de failles longitudinales. L'ensemble marque le passage d'un charriage très important: le grand charriage du Condroz qui a fait s'avancer vers le nord, de quelques dizaines de Km, les massifs paléozoïques affleurant au sud. Ce charriage, qui traverse de part en part la Belgique, constitue un trait majeur de la tectonique hercynienne.

Avant celle-ci, toutefois, la période calédonienne a fait sentir ses effets dans notre pays. Cambrien et Silurien, en effet, sont surmontés en discordance par les terrains dévonien, qui débutent par un poudingue de base.

Le Dévonien, qui affleure

très largement en Haute Belgique, et dont les couches y atteignent plusieurs milliers de m. d'épaisseur, est constitué, en gros, de formations schisto-gréseuses à la base et au sommet, séparée au milieu par des formations calcaires. L'ensemble marque une transgression du sud vers le nord: le Dévonien inférieur ne dépasse pas, vers le nord, la bande silurienne du Condroz; en outre, les terrains s'épaississent vers le sud et y accusent des facies moins littoraux qu'au nord.

Avec les îlots cambriens déjà cités, le Dévonien inférieur, grésoschisteux, constitue le sous-sol de l'Ardenne. Il y dessine trois plis majeurs: l'anticlinal de l'Ardenne déjà cité, puis, au sud, le synclinal de Neufchateau, et enfin, à la bordure sud du socle, l'anticlinal de Givonne, à demi enfoui sous les terrains secondaires de couverture.

Entre l'Ardenne et le grand charriage du Condroz, apparaissent deux autres unités tectoniques, qui se relaient: ce sont le synclinorium de Dinant et, à l'est, le massif (synclinal) plus modeste de la Vesdre.

Le premier correspond à l'Entre-Sambre-et-Meuse et au Condroz: entouré de Dévonien inférieur, puis d'une bordure de dévonien calcaire, il est essentiellement constitué d'un faisceau de plis parallèles, où les anticlinaux voient affleurer du dévonien tout-à-fait supérieur, essentiellement gréseux, tandis que les

synclinaux sont surtout formés de calcaires appartenant au Carboniférien inférieur (Calcaire carbonifère).

Le Massif de la Vesdre qui s'étend, à l'E de Liège, dans la vallée de la Vesdre et au nord de celle-ci, constitue en réalité un demi-synclinal, le charriage du Condroz ayant sectionné son bord septentrional. On y retrouve les terrains précédents et, en outre, le Houiller.

Le Dévonien, nettement réduit en épaisseur et amputé de sa partie inférieure, se retrouve au nord du charriage du Condroz, sur les deux flancs du synclinal de Namur, qui sépare le charriage de l'anticlinal du Brabant.

Enfin, à l'E du synclinorium de Dinant, une ondulation en dôme de la grande faille de charriage a permis à l'érosion de faire apparaître, en fenêtre, des terrains du substratum sous le massif charrié. Dans cette fenêtre de Theux affleurent presque tous les étages du socle paléozoïque, du Houiller au Cambrien, ce dernier accolé au massif cambrien de Stavelot et difficile à distinguer de ce massif.

Le terrain carbonifère, qui repose en concordance sur le dévonien, comporte à la base une formation essentiellement calcaire, le Calcaire carbonifère ou Dinantien, et au sommet des roches schisto-gréseuses, avec veines de charbon intercalées, qui constituent le Houiller.

Alors que toutes les formations vues jusqu'ici sont d'origine marine, le Houiller comporte essentiellement des couches continentales, d'origine deltaïque et fluviatile. Son épaisseur totale dépasse 3 km et les couches de houille qu'il contient constituent la principale richesse minière du pays.

Terrain le plus récent du socle paléozoïque, le Houiller apparaît évidemment au centre des synclinaux assez profonds de ce socle. Deux d'entre eux seuls sont intéressants au point de vue de l'exploitation de la houille: le synclinal de Namur, dont l'axe suit sensiblement le sillon Haine-Sambre-Meuse, et le longduquel s'alignent des bassins charbonniers connus et en exploitation depuis très longtemps, et le "synclinal" de la Campine, situé de l'autre côté de l'anticlinal du Brabant, et entièrement caché sous une forte épaisseur de sédiments postpaléozoïques. De ce synclinal, n'est en réalité connu que le versant sud. Le houiller y fut découvert par sondages en 1901, et y est exploité depuis la fin de la première guerre mondiale.

Les formations dévono-carbonifères du socle comprennent une grande épaisseur de terrains, de facies essentiellement néritique ou littoral. Les calcaires, notamment, se sont pratiquement tous déposés en eau peu profonde. Ces sédiments ont rempli une fosse géosynclinale, où l'affaissement, grosso modo compensait la sé-

dimentation. A la fin, le Houiller continental marque le stade final de la sédimentation. Ensuite s'est déclenché au carbonifère supérieur l'effort principal de l'orogénèse hercynienne, et nous avons donné ci-dessus les plis principaux que celle-ci a formé. Les déformations sont surtout marquées au sud de l'anticlinal de Brabant. Le flanc sud du synclinal de Namur, par exemple, est en grande partie constitué par un empilement d'écaillés, ce qui y complique beaucoup l'exploitation des couches de houille, tandis que le bassin houiller de Campine n'est guère affecté que par des failles radiales d'âge plus récent.

L'orogénèse hercynienne a aussi fait surgir, à l'endroit de la Haute Belgique, un relief montagneux qui fut ensuite peu à peu pénéplané. Sur le socle ainsi aplani, les sédiments de couverture les plus anciens qui apparaissent en affleurement sont d'âge triasique: ils forment une mince bande au bord nord-est de la Lorraine belge et contiennent notamment des conglomérats grossiers, lesquels indiquent que la pénéplanation du socle n'était pas encore achevée à cette époque.

Les formations du Jurassique, qui forment le sous-sol de la Lorraine belge, reposent à l'est sur le Trias, à l'ouest sur le socle paléozoïque. Elles comprennent des dépôts variés, où l'élément calcaire est fréquent et souvent plus ou moins mêlé à des sédiments détritiques fins.

Sur le bord nord du "Massif ardennais" les plus anciens sédiments de la couverture appartiennent au Crétacé. Ils forment trois massifs principaux, l'un dans le Bassin synclinal de la Haine, déjà mentionné, les deux autres en Hesbaye et dans le Pays de Herve. Ces deux dernières régions naturelles, situées de part et d'autre de la Meuse en aval de Liège, représentent, la première la partie est des plateaux de Moyenne Belgique, la seconde un plateau fortement entamé par l'érosion situé entre la Meuse, la Vesdre et la frontière.

Le Crétacé comporte à la base des sables et argiles d'origine continentale, que recouvrent des marnes et surtout des craies, ces dernières largement prépondérantes. La transgression marine s'est faite vers l'est dans le bassin de la Haine, vers le sud-ouest dans le Pays de Herve et la Hesbaye. Elle a dû recouvrir très largement la Haute Belgique, car on retrouve des vestiges de crétacé marin dans le massif culminant de la Baraque Michel.

Les dépôts tertiaires qui recouvrent la Basse et la Moyenne Belgique y ont été essentiellement amenés par plusieurs transgressions d'une mer qui était en somme l'ancêtre de l'actuelle mer du Nord. Ces transgressions, toutefois, se sont faites dans diverses directions. Les dépôts éocènes couvrent la plus grande partie du territoire précité: ils forment le sous-sol des Flandres (ouest de la Basse Belgique) et de

la plus grande partie de la Moyenne Belgique. Essentiellement sableux en Moyenne Belgique, leurs dépôts sont argilo-sableux dans les Flandres. Ils indiquent plusieurs phases d'avancée et de recul de la mer, dont un recul marqué par des dépôts continentaux, et une avancée (en direction SE) suffisante pour avoir atteint l'ouest du Massif ardennais.

Les dépôts oligocènes, également sablo-argileux, affleurent surtout suivant une zone irrégulière, allongée en direction NW-SE, au nord des sédiments éocènes, mais s'étendent aussi en outre sur les plateaux de l'E de la Moyenne Belgique. A l'Oligocène supérieur s'est produite, en direction NS, la dernière transgression marine ayant atteint la Haute Belgique: elle a laissé de nombreux dépôts sporadiques dans le Condroz, pour la plupart conservés dans des poches de dissolution du calcaire carbonifère, et a même atteint, selon toute vraisemblance, le flanc nord du massif de la Baraque Michel.

Les sédiments miocènes affleurent suivant une zone plus réduite encore, située au NE de la bande principale de dépôts oligocènes. Essentiellement sableux, et en outre continentaux dans la partie est, ils indiquent surtout que la mer, à cette époque, s'est cantonnée dans le nord du pays.

Une dernière transgression marine se développa au Pliocène infé-

rieur: l'érosion a conservé ses dépôts, en Moyenne Belgique, sur les sommets d'une série de collines, dont les plus méridionales, les collines des Flandres, s'alignent en direction EW sur plus de 100 Km à l'WSW de Bruxelles. Mais les dépôts pliocènes n'affleurent de façon continue que dans le NE du pays. Ils forment essentiellement le sous-sol de la Campine (1), moitié est de la Basse Belgique, et sont essentiellement sableux. Dans le nord-est de la Campine, ils sont surmontés de sables et graviers continentaux, avec argiles et lignites au sommet, que l'on range actuellement dans le Quaternaire.

Bien que généralement peu épais, et non représentés sur les cartes géologiques, les dépôts quaternaires n'en sont pas moins étendus, et leur rôle au point de vue pédologique est évidemment primordial. Il suffit de signaler ici qu'ils comportent surtout, outre les dépôts cités ci-dessus, et les dépôts de terrasses fluviales fréquents dans les rivières du bassin de la Meuse, des sables de couverture et des limons, d'origine nivéo-éolienne et nivéo-fluviale. Les premiers couvrent une partie très importante de la Basse Belgique, les seconds recouvrent essentiellement les plateaux de Moyenne Belgique, et s'étendent même en partie sur ceux de Haute Belgique. C'est à leur couverture de limon que la Moyenne Belgique en général, et plus particulièrement la Hesbaye, doivent la fertilité de leur sol.

(1) dont le bas-plateau de Campine, précédemment cité, ne forme qu'une partie.

A la fin du Quaternaire et pendant l'Holocène se sont encore formés, d'une part les alluvions des vallées, d'autre part les dépôts de la Plaine maritime. Cette dernière forme une plaine subhorizontale d'altitude inférieure à 5 m, qui borde sur dix à quinze Km le littoral et se prolonge au N, le long de la frontière hollandaise, jusqu'aux environs d'Anvers. Ses dépôts d'argile, sable et tourbe correspondent aux dernières incursions de la mer et aux exondations intermédiaires, phénomènes dont les plus récents datent de la période historique. Ils ont été accompagnés de la formation d'un cordon de dunes littorales.

5. L'histoire géomorphologique

L'histoire du sous-sol de la Belgique doit naturellement être complétée par l'histoire de son relief. Celle-ci, toutefois, est dans l'ensemble moins bien connue et est en partie l'objet d'interprétations diverses, qui en rendent difficile un résumé synthétique.

Comme on peut le déduire facilement de l'exposé géologique, la Haute Belgique, ayant émergé plus tôt que le reste du pays, montre des traces de surface d'érosion plus anciennes.

A la bordure sud du socle, un glacis à pente sud, conservé en un mince liséré au contact des terrains de couverture de la Lorraine belge, représente la pénéplaine post-hercynienne exhumée, qui date du début du Secondaire. Sur le flanc nord du mas-

sif paléozoïque, la pénéplénation, plus récente, doit dater de la fin du Secondaire. On admet que cette pénéplaine pré-maestrichtienne (1), déformée en dôme, est conservée sur les hauts sommets aplanis de l'Ardenne, entre 500 et 600 m d'altitude. Les sommets plus élevés représentent vraisemblablement des monadnocks. Pénéplaine et monadnocks ont été recouverts par la mer du Crétacé supérieur, dont il subsiste des dépôts sporadiques.

En dessous une seconde surface, également bombée, a été distinguée dans l'ouest de l'Ardenne. Elle s'élève en outre régulièrement de l'ouest à l'est, de 400 jusqu'à 480 m d'altitude, et cette pénéplaine incomplète a été considérée comme éocène.

En dessous de ces surfaces anciennes, qui se retrouvent surtout dans l'allure d'ensemble des sommets de la région, l'Ardenne montre la trace de niveaux d'érosion plus restreints, représentés surtout par des replats, qui s'étagent à la bordure nord du massif et dans les principales vallées. On assimile ces niveaux en partie à des gradins de piedmont (piedmont benches), en partie à des "niveaux d'aplanissement partiels" (partial planation levels).

Ces niveaux étagés sont attribués à des exhaussements épirogé-

(1) le Maestrichtien représente le dernier étage du Crétacé.

niques du massif ardennais, ou encore, suivant certains, à des phénomènes eustatiques. Au dessus, les parties hautes du plateau offrent également, dans la partie centrale, un aspect sénile. En bordure, par contre, les rivières rajeunies montrent des vallées profondes et pittoresques.

Au sud de l'Ardenne, la Lorraine belge, à structure monoclinale, est découpée en cuestas par suite de l'existence de niveaux plus durs, formés de grès calcaireux et de calcaires. Au nord, le plateau de l'Entre-Sambre-et-Meuse et du Condroz, à structure plissée, possède un relief appalachien, dû à l'alternance de longues dépressions calcaires et de crêtes gréseuses. On retrouve, sur les crêtes, le prolongement de niveaux d'érosion du bord nord de l'Ardenne, et l'un de ces niveaux y acquiert, vers 300 m d'altitude, une extension considérable. Dans l'est du Condroz, ces niveaux apparaissent nettement taillés sous la surface de base de la transgression oligocène, la dernière qui ait laissé des traces dans la région. Leur âge néogène est ainsi établi. Les crêtes arrondies du plateau indiquent une surface au stade de maturité, fortement entamée en bordure et le long des principales rivières par un rajeunissement marqué, qui donne souvent à ces rivières des versants rocheux à la traversée des zones calcaires.

l'Ourthe, une longue zone déprimée, la Famenne, qui correspond à l'affleurement de schistes tendres du Dévonien supérieur. De ci, de là, des massifs de calcaire corallien y forment de petites collines arrondies, souvent disposées plus ou moins en chapelet. On retrouve également, sur les bords de cette dépression et au sommet des crêtes basses et des collines qu'elle comporte, des traces de niveaux d'érosion étagés.

Enfin, la Haute Belgique comprend encore le Pays de Herve, plateau à pente douce vers le NW, d'altitude comparable au Condroz, mais fortement entamé par l'érosion des ruisseaux affluents de la Meuse, grâce au bas niveau de base offert par ce fleuve. Aussi la surface originelle du plateau, arasant du massif crétacé, n'est-elle plus conservée qu'en d'étroites crêtes d'interfluves, tandis que les vallées pénètrent profondément dans le socle paléozoïque.

Les bas-plateaux qui constituent la Moyenne Belgique accusent des différences dues surtout à leur plus ou moins grande attaque par l'érosion fluviale, et qui sont en partie en relation avec la nature de leur substratum. A l'est, la Hesbaye, à substratum crayeux recouvert d'une épaisse couche de limon, est un plateau mollement ondulé, qu'entament uniquement de rares rivières, mais à la surface duquel existe un riche réseau hydrographique constitué de vallées sèches. Au centre le plateau brabançon possède un sous-

sol sableux, est recouvert de limon moins épais, et est fortement disséqué par les rivières, dont les principales atteignent au sud le socle paléozoïque sous-jacent. A l'est enfin, le plateau hennuyer offre des aspects intermédiaires et plus variés: le sous-sol y est tantôt crayeux (bassin de la Haine), tantôt sableux, le socle paléozoïque affleure par places, le limon est généralement peu épais, etenfin, à côté de profondes échantures, subsistent des parties conservées du plateau assez importantes.

Au nord de ces trois unités morphologiques s'étend une zone de collines, qui représentent en grande partie des buttes - témoins du plateau lui-même: ce sont notamment les collines des Flandres, déjà citées, et, entre Louvain et Diest, le Hageland.

Comme vu à propos du réseau hydrographique, la dernière transgression marine ayant couvert la région date du Pliocène inférieur. Mais les dépôts ne subsistent en lambeaux isolés que sur les collines de bordure. La surface du plateau due à l'érosion continentale est plus récente, mais on a supposé qu'elle différerait peu du fond de mer émergé. On tend actuellement à attribuer un rôle protecteur aux "prêles", cailloutis de base des formations quaternaires. Ceux-ci se seraient déposés dans ou en bordure de dépressions, mais, en dessous des limons, ils couronnent actuellement les sommets: ils semblent donc bien avoir provoqué des inversions de relief. Tout récemment, en outre, des

surfaces d'aplanissement partiel quaternaire ont été distinguées dans le nord du plateau de Hesbaye, dont l'origine serait ainsi composite. Les vallons secs, partout fréquents en Moyenne Belgique, sont considérés comme surtout d'origine périglaciaire, et développés au moment où un "tjale" rendait le sous-sol imperméable et permettait ainsi un intense ruissellement. Les limons éoliens, enfin, ont évidemment fossilisé le relief antérieur, mais ont été depuis et sont encore l'objet de profonds remaniements sur les pentes.

Le bas-plateau de la Campine, situé à l'extrême E de la Basse-Belgique, entre la Meuse et le cours supérieur du Démer, possède une surface sensiblement plane, qui descend vers le N depuis l'altitude de 100 m jusqu'à se confondre avec la plaine environnante. Couvert par les épais graviers d'une importante terrasse de la Meuse, il est limité de trois côtés par des abrupts qui correspondent aux versants des deux rivières limitrophes et à une faille ayant joué récemment. Il forme un plateau très peu élevé, mais nettement individualisé et qui, à peine entamé par l'érosion, est encore en pleine jeunesse. L'inversion du relief provoquée par la couverture de graviers résistant à l'érosion est ici nettement marquée.

Le reste de la Basse Belgique est un pays de plaine. On y distingue à l'est la Campine, à sous-sol sableux, et à l'W, la Flandre où affleurement en général, sous le sable quaternaire,

des formations argileuses de l'Eocène. L'ensemble représente essentiellement une surface d'érosion sénile, mais dont les inégalités sont en partie colmatées par les dépôts quaternaires et ainsi plus ou moins effacées.

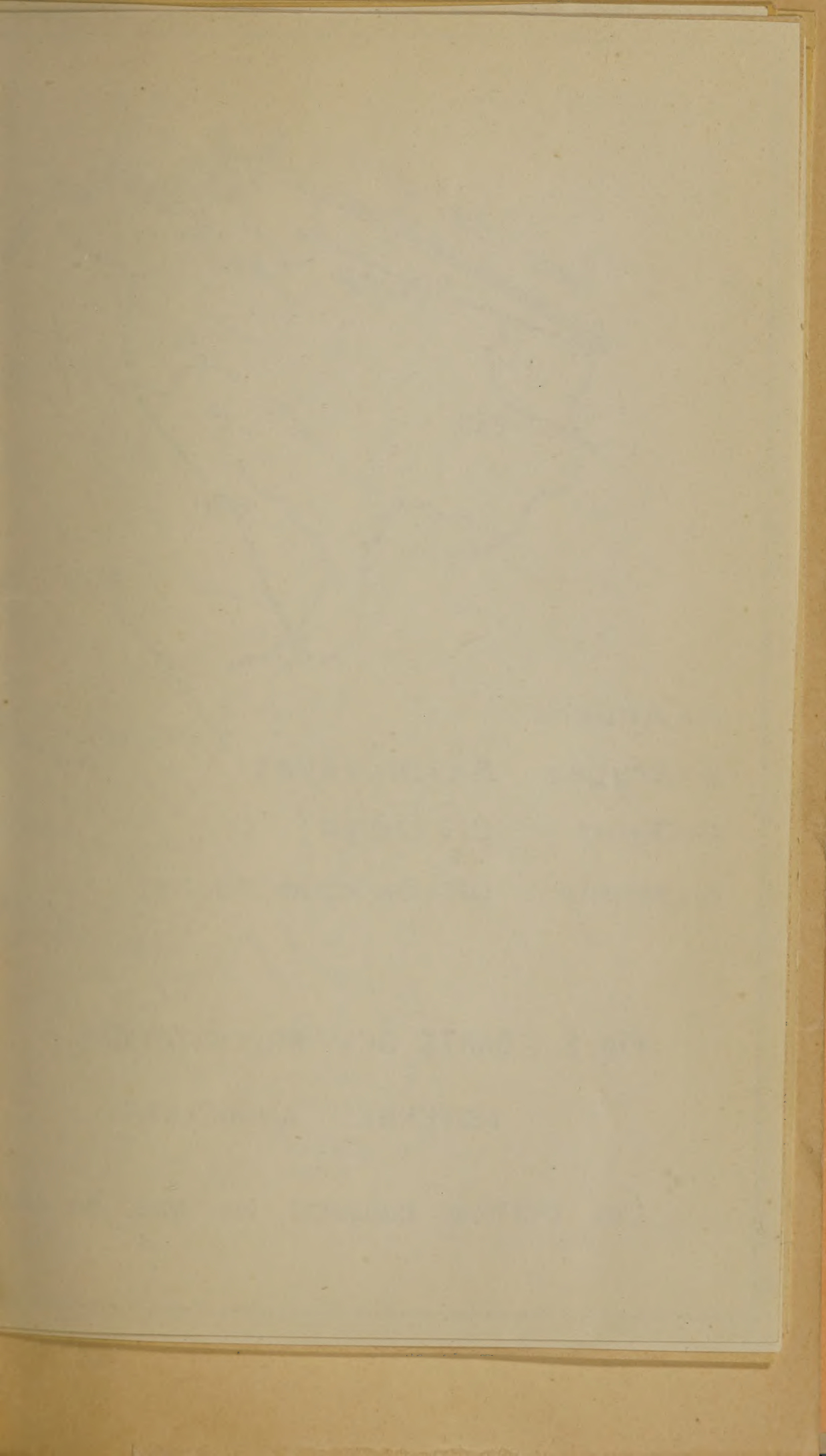
Comme en Moyenne Belgique, le Pléistocène et même le début de l'Holocène ont été marqués par l'alternance des phénomènes de creusement, sur le sol gelé des périodes froides à climat périglaciaire, et de phénomènes d'accumulation, celle-ci d'origine nivéo-éolienne, nivéo-fluviale et peut être aussi fluviale. Le vent a apporté ici des sables de couverture d'épaisseur variable, dont la surface présente un micro-relief particulier, en légères ondulations et vastes dépressions fermées très peu profondes.

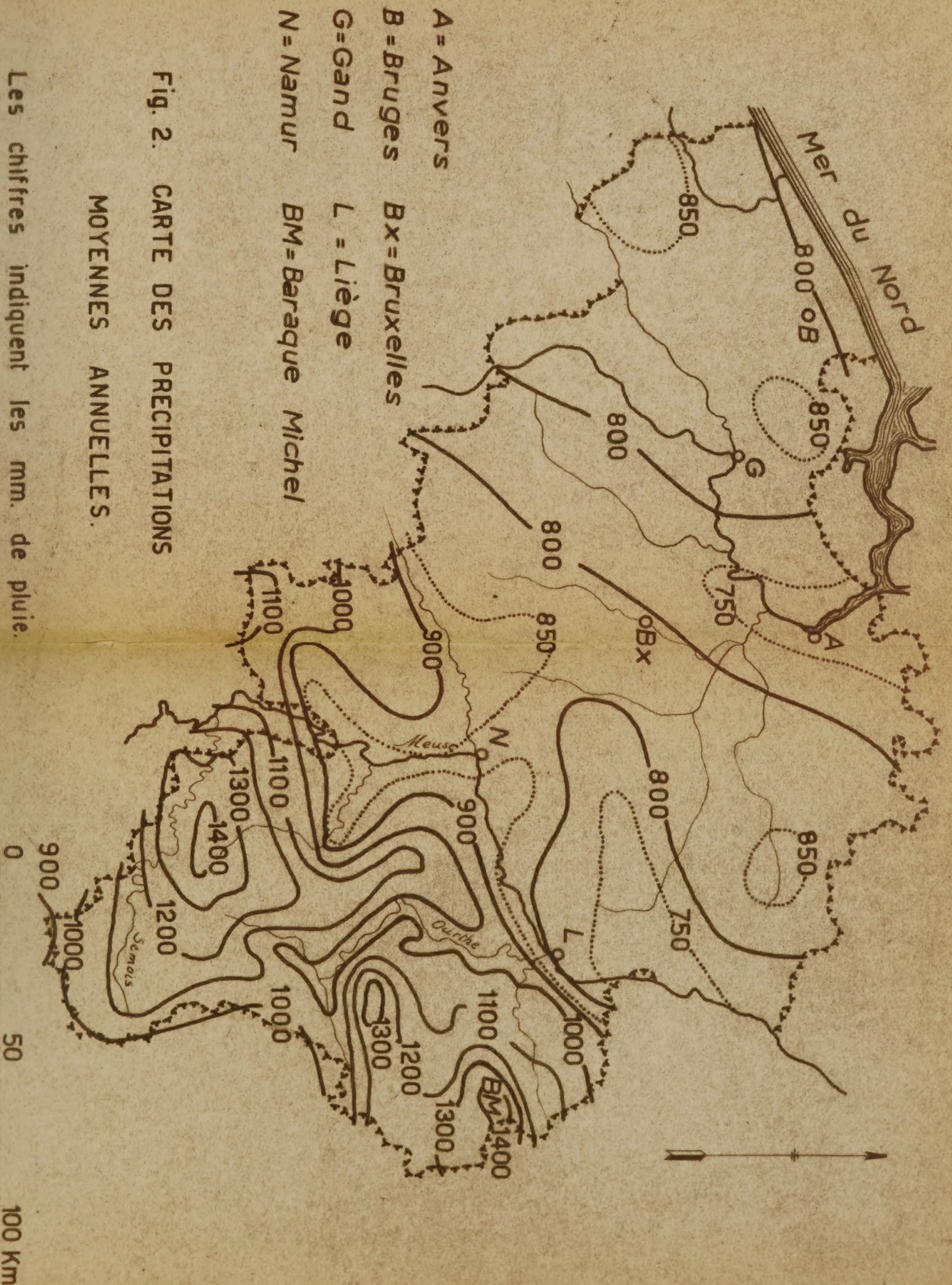
Enfin, il s'est produit un colmatage important des plaines alluviales, avec débordements locaux dans les cuvettes du micro-relief et formations de tourbe, sous l'influence du relèvement postglaciaire du niveau marin et, tout récemment, des déboisements dus à l'activité humaine.

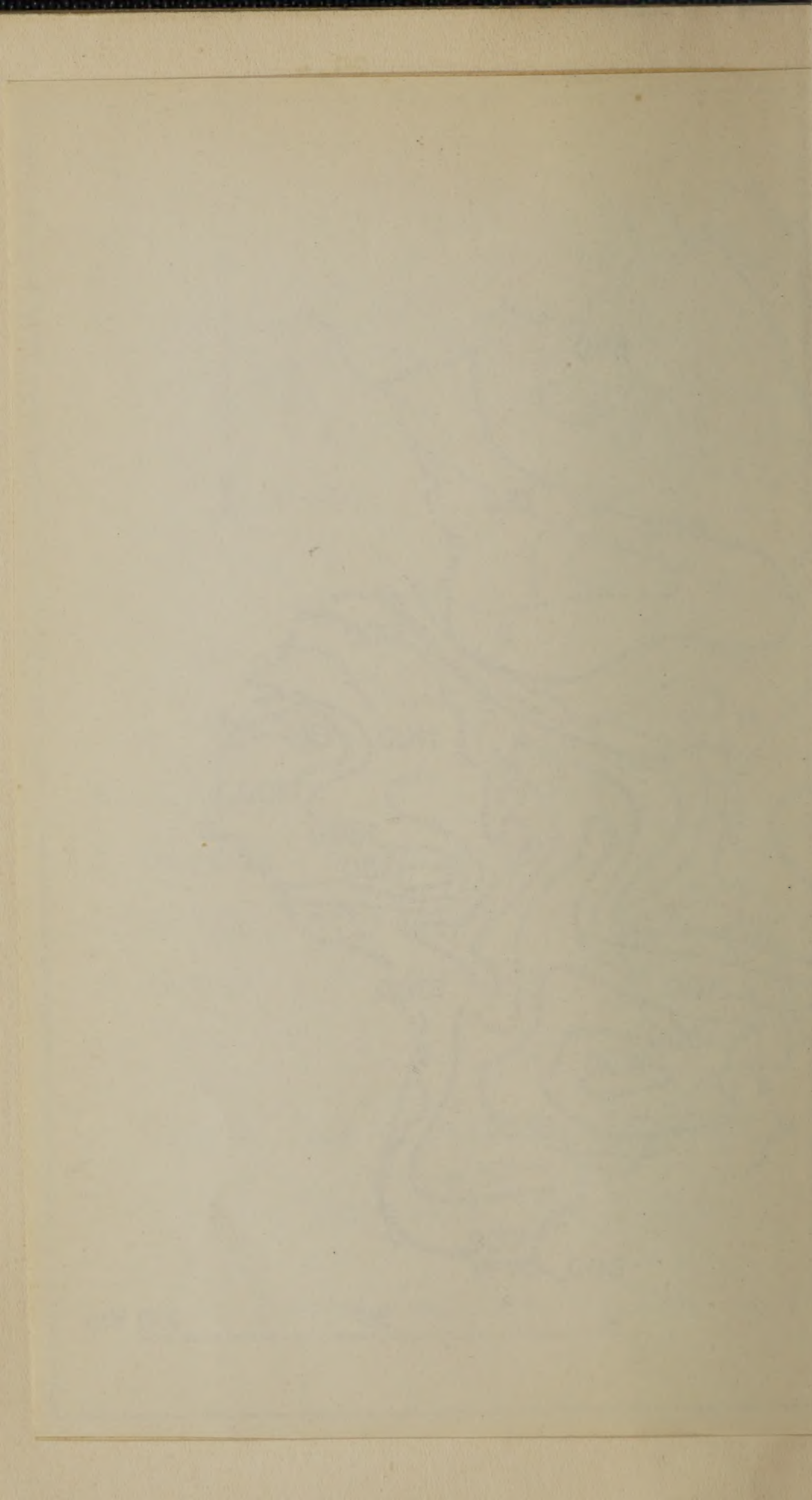
A l'ouest et au nord de la Flandre, la Plaine Maritime, comme déjà dit, a vu des invasions marines holocènes, alternant avec des phases continentales. La dernière invasion, qui date du IV^e siècle, envahit une plaine tourbeuse, y creu-

sant des chenaux (criques) qu'elle emplît de sable, et déposant ailleurs de l'argile, qui finit même par recouvrir aussi les chenaux. Ces dépôts, renforcés par l'établissement de digues, finirent par déterminer l'exondation de la région. Ensuite le tassement de la tourbe, plus marqué en dehors des chenaux où elle était fortement érodée, provoqua une inversion de relief: les chenaux forment actuellement saillie sur une plaine d'accumulation extrêmement plate, et routes et lieux habités s'y établissent de préférence.

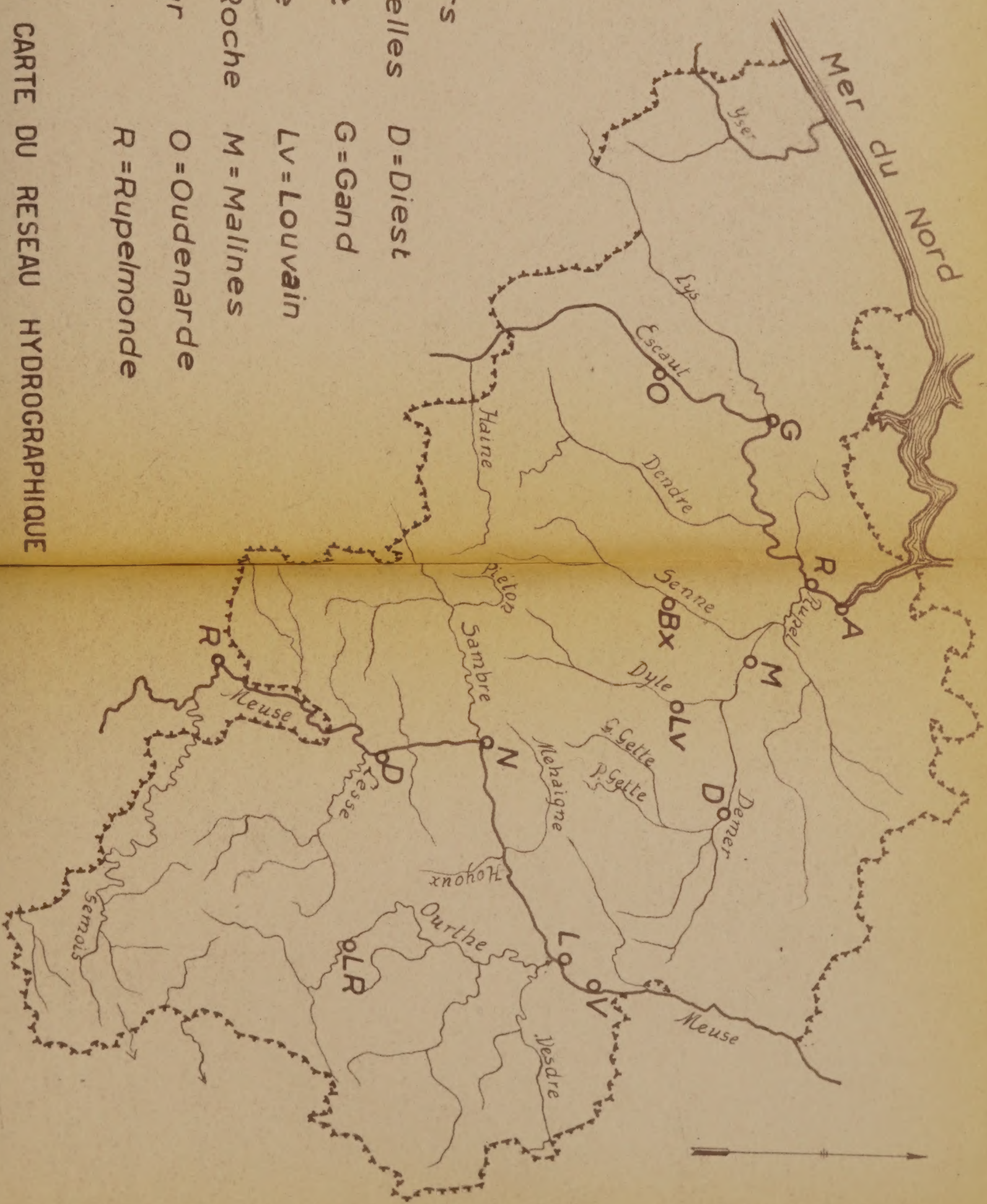
Le littoral enfin est constitué par une plage sableuse, bordée d'un mince cordon de dunes, que près de la mer on s'est efforcé de fixer par une végétation appropriée. Au sud, la zone de dunes est plus large, et abrite quelques fonds humides, à maigres cultures. Mais le paysage est, partout ailleurs, fortement modifié par l'influence de l'homme: une exploitation touristique intense s'y est développée, et les dunes sont en voie de disparition rapide sous la poussée incessante des villas qui bordent presque partout la crête d'un cordon subcontinu.











- A=Anvers
- Bx=Bruxelles
- D=Diest
- D=Dinant
- G=Gand
- L=Liège
- LV=Louvain
- LR=La Roche
- M=Malines
- N=Namur
- O=Oudenarde
- V=Visé
- R=Rupelmonde

Fig. 3 - CARTE DU RESEAU HYDROGRAPHIQUE

DE LA BELGIQUE

0 50 Km

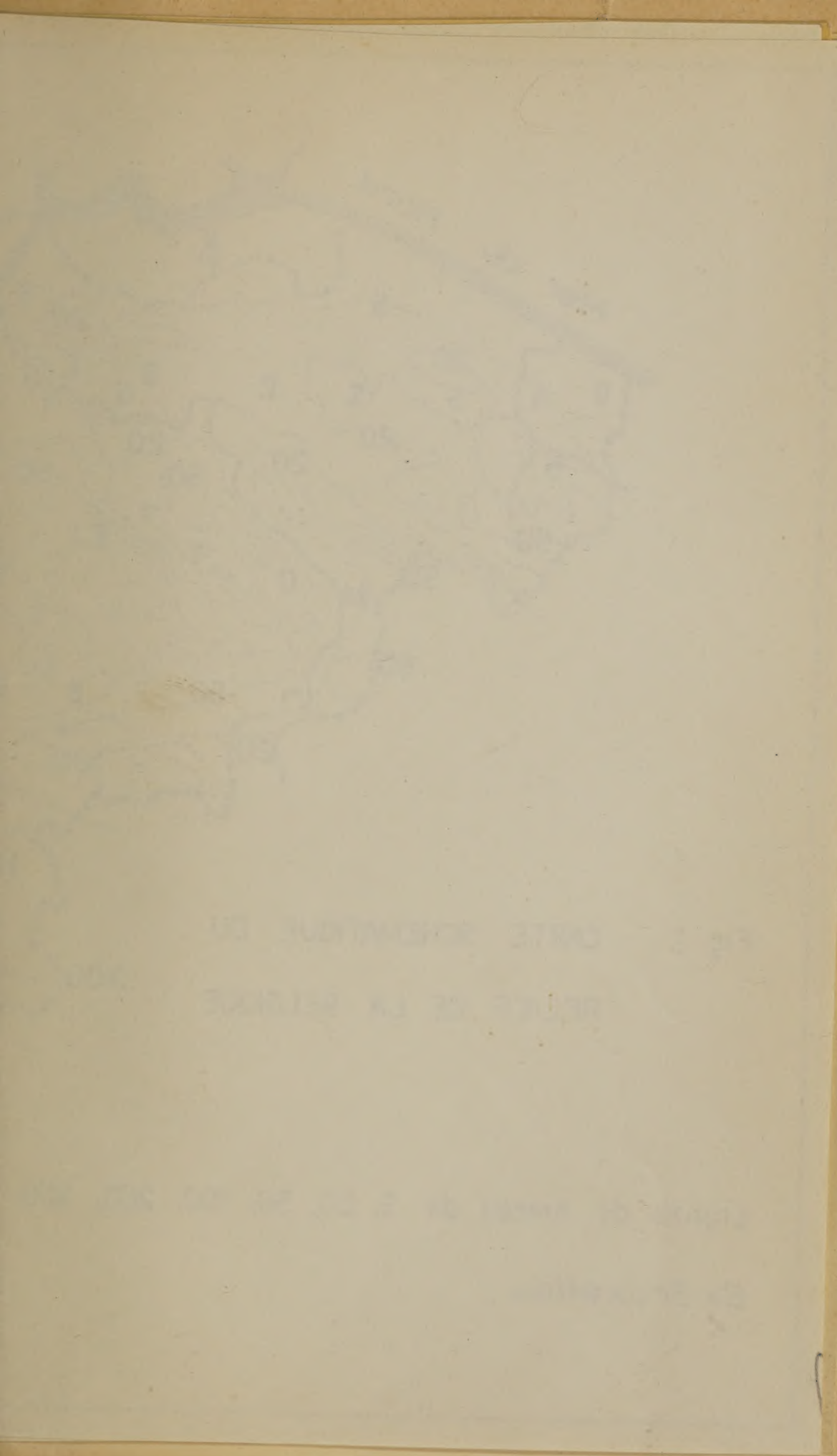






Fig. 1 CARTE SCHEMATIQUE DU
RELIEF DE LA BELGIQUE

Lignes de niveau de 5, 20, 50, 100, 200, 300, 400, 500 et 600 m.

B = Bruxelles

0 50 100 km

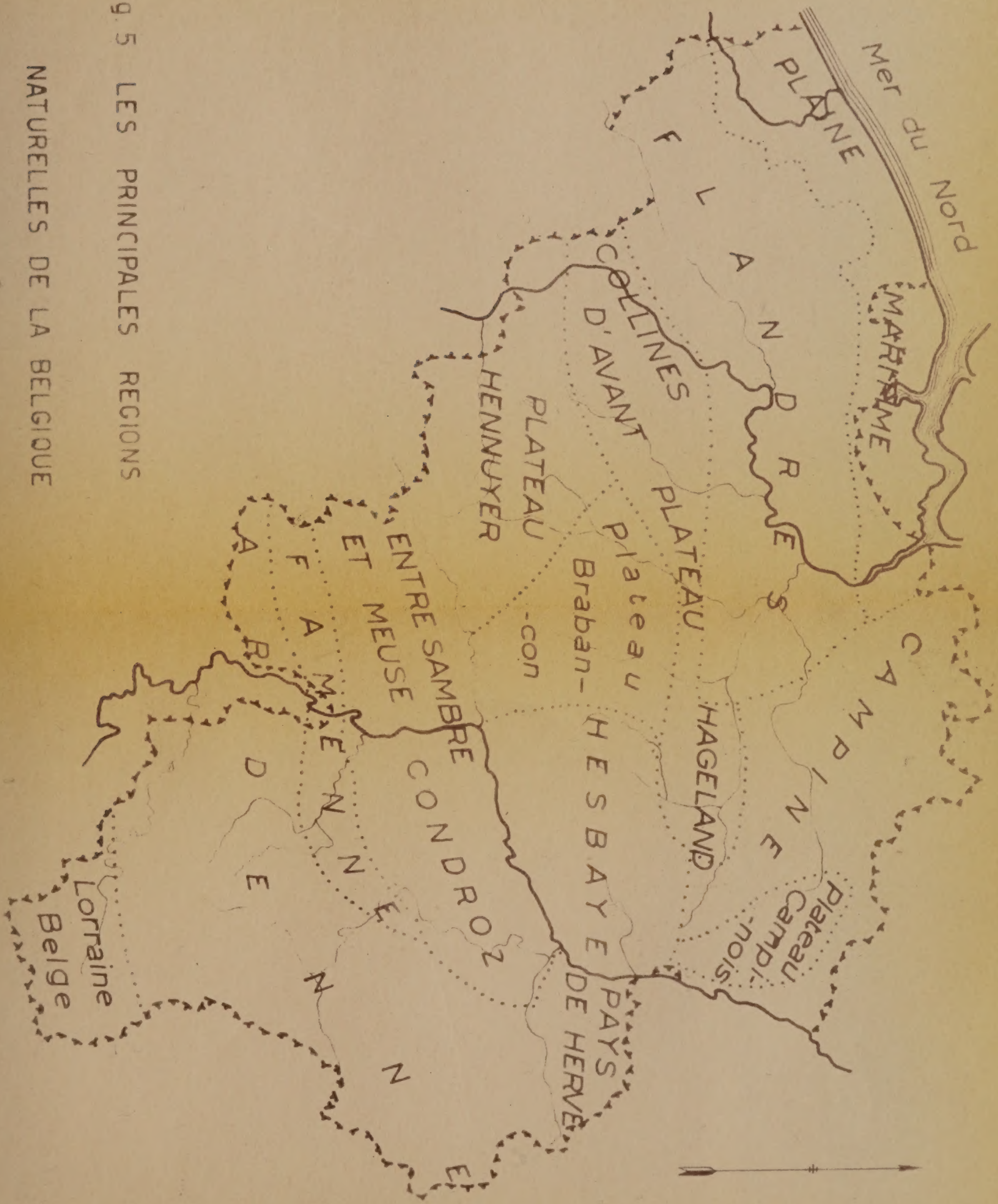


Fig. 5 LES PRINCIPALES REGIONS
NATURELLES DE LA BELGIQUE

8

FOURTH INTERNATIONAL CONGRESS
OF SOIL SCIENCE
Amsterdam
1950

GUIDE
TO THE
POST - CONGRESS EXCURSIONS
IN BELGIUM

o

August 18th : Liège et Condroz
August 19th : Namur et Marche-les-Dames

o

o

INSTITUT AGRONOMIQUE DE GEMBLoux

PEDOLOGICAL EXCURSIONS

GENERAL INFORMATION

THURSDAY, August 17th :

Arrival at Liège in front of the Guillemins Railway Station.

Lodging at the Hôtel du Chemin de Fer and the Hôtel de l'Univers across from the Station.

The meals will be taken at the Hôtel du Chemin de Fer.

FRIDAY, August 18th :

8.30 a.m. : Departure of the motor coaches from in front of the Railway Station. Prepared luncheons provided by the hotel are to be taken away by each Member.

1.00 p.m. : Lunch at the Provincial School of Agriculture at Abée-Scry. Soup, coffee, tea and refreshments will be obtainable.

5.30 p.m. : Arrival at Namur; reception by the Town authorities at the "Hôtel de Croix". The Members of the Congress will be given information concerning lodging. Dinner will be served in the respective hotels of the Members.

After dinner a tour can be arranged about the town and to the Citadel for any Members who wish to participate.

SATURDAY, August 19th :

8.30 a.m. : Departure of the Motor coaches from in front of the Railway Station, for Marche-les-Dames

1.00 p.m. : Lunch at the Hôtel Victoria, Namur (near Railway Station).

2.30 p.m. : Leave-taking reception by the provincial authorities at the seat of the Government of the Province, Place Saint-Aubain.

3.00 p.m. : Departure towards Brussels.

EXCURSION

FRIDAY, Aug. 18th

First stop : Visit to a typical industrial landscape at St-Nicolas in the coal-mining basin of Liège.

Almost all the soils of the region have been altered by man. This fact arose from ancient mining when debris hillocks were spread out on the fields. The soils which resulted were generally of poor quality. An interesting utilization was found for them however. For lack of better soil they have been used for market gardening, so necessary at the periphery of a large industrial city. Contrary to farming, market gardening can employ poor soils because of the frequent tillage and care which these soils receive. It is the business of the city-planner, the agricultural expert and the cartographer to find out the soils which could be used for market gardening even if large-scale levelling were to be necessary.

It would also be interesting to reforest the superficial and skeletal soils which are numerous in the region.

Descent towards Liège along the hillside of Cointe with a panoramic view of the industrial city.

After crossing the Meuse River the road climbs to the plateau on the right bank of the river, and reaches Neuville-en-Condroz. Here a brief visit will be paid to the American Cemetery.

Second stop :

Neuville-en-Condroz (fig. n° 1) is located in a small natural region called "Ardenne Condruzienne" that owes its name to the schisto-sandstone bed-rock of the Lower Devonian which also characterizes the French and Belgian Ardennes.

As a result of an anticline, the anticline of Condroz, this substratum outcrops along a strip of an average width of 4 Km, which forms a narrow plateau that crosses a large part of Belgium roughly in an East-West direction

This plateau also called the "Crest of Marlagne" dominates toward the North the valley of the Meuse and toward the South the region of Condroz properly speaking. It has many woodlands and is sparsely populated compared to the surrounding territory.

In the part of the region which lies in the Province of Liège, the soils are developed on a thick layer of aeolian loam which is responsible for a relatively good fertility.

The loose rock subjacent to the loams is constituted by the products of weathering of the schisto-sandstone complex, *i.e.* a very compact and impermeable clay, which explains the frequency of the appearance of the phenomena of gley.

The series of profiles to be seen at the stop are as follows :

Profile 1 :

A soil on an area which was deforested a short time ago (50 years) with an eluvial horizon still visible, acidity definitely increasing with depth.

Profile 2 :

A soil on an area which was deforested several centuries ago; the eluvial horizon has disappeared.

Profile 3 :

The clay formed by weathering is shown subjacent to the loams.

Lunch at the Provincial School of Agriculture at Abée-Scry.

Third stop :

Visit to a landscape of the Condroz region at Villers-le-Temple (fig. 2).

In this vast natural region, the geological bed-rock is essentially composed of psammites of the Upper Devonian and of carboniferous limestone alternating in narrow strips parallel to the valley of the Meuse.

Psammites resist erosion better than limestones. The topography of the region is thus characterized by the existence of long parallel hills separated by depressions. The road followed by the excursion crosses several of these hills and depressions.

Condroz is a region of mixed husbandry, both cattle and crops. The cartographer will have to find out which soils are best suited to grass-land or crops, with a view to informing the farmers who, following the economic situation, will turn their attention to one or the other direction.

Profile 1 : Crest soil on psammite. ✓

Profile 2 : Soil on clay formed by the dissolution of limestone. ✓

Profile 3 : Soil on Loessial loam of which there exist numerous patches on the flank of the crest. ✓

Profile 4 : Soil on Loessial colluvions.

Profile 5 : Soils on tertiary sands which occupy numerous pockets of dissolution in Condroz ✓

All the journey to Namur runs across the Condroz. One observes that many of these psammitic crests are covered with forest.

One passes in front of the fortified farm of Hemptinne

Arrival at Namur about 5.30 p.m. at the "Hôtel de Croix".



SATURDAY August 19th.

8.30 a.m. : Departure towards Marche-les-Dames.

The national forest of Marche-les-Dames (Domaine de Marche-les-Dames) is situated 8 Km. East of Namur. It is a very ancient forest which has remained nearly intact through the times, having never been deforested.

It has become particularly well-known since the death there of King Albert in 1934.

The soil is extremely variable owing to a very diverse parent material and to irregular topographic conditions.

In this national forest, the Institut Agronomique de Gembloux (State College of Agriculture of Gembloux) is conducting researches in forestry biology.

To this end, studies are made of :

Lithology (soil mapping) - (fig. 3).

Degree of evolution of the profiles (dynamics of the soils).

Plant sociology.

Animal sociology.

Two important ecological agencies : water and air.

Humus (C/N ratio, etc ...).

Several investigators are engaged in this work of synthesis which will augment our knowledge in forestry biology.

GENERAL OBSERVATIONS ON THE NATIONAL FOREST

a) Geology and lithology :

The forest lies on carboniferous limestone often dolomitic, and on the psammities of the Upper Devonian.

On the limestone and dolomites one observes rendzinas which are more or less leached, and humo-carbonates.

Large parts of the forest are covered with an heterogeneous deposit of dubious stratigraphy (On α on geological maps) very rich in small white quartz pebbles embedded in a sandy or argillaceous mass.

Locally appear patches of Loessial loams.

b) Topography :

In general the plateau slopes down gently towards the Meuse. Where the carboniferous limestone and the psammities of the Famennien are in contact there exist erosion depressions corresponding to schist beds.

c) Plant Sociology (Heinemann's survey) :

Querceto-carpinetum lithospermetum (1) on outcropping limestone and dolomites.

Querceto-carpinetum primulatosum (2) on rendzines with Mercurialis facies on deeper soils and Corydale facies at the foot of slopes.

Querceto-carpinetum stachyetosum (3) on the plateau thinning out in species on the Famennien.

Querceto-betuletum (4) from degradation, locally.

Acereto-fraxinetum in certain deep depressions.

d) Animal sociology (Decelle's study) :

Numerous surveys have already been made with a view to determining the ecological significance of either species or associations.

e) Condition of the forest :

High forest with standards on coppice of "Chênaie mixte" with numerous species especially on rendzines and loams, and fewer species on psammites.

Originally the forest was treated as coppice under thin high forest. Some birches and sorbs scattered in the forest are remaining witnesses of this fact.

In numerous places the beech, favoured by man, overruns, and degrades the soils.

PROGRAMME OF THE EXCURSION

The purpose of the excursion is to visit some of the places of research in the national forest.

Profile 1 : On loessial loam of the slopes.

Leached brown earth podsolized on the surface by the coppice treatment and by the wind (leaves taken away).

Querceto-betuletum from degradation, few in number of species.

Profile 2 : On psammites of the Famennien.

Brown earth degraded on the surface by the coppice treatment, and locally by the overrunning of beech.

(1) Braun-Blanquet, Tüxen

(3) Tüxen

(2) Tüxen et Diemont

(4) Tüxen

Querceto-carpinetum stachyetosum few in species,
locally altered into Quercion (Q-B).

Profile 3 : On On_x with white pebbles.

Leached brown earth with superficial degradation
under beech.

Querceto-carpinetum stachyetosum more numerous in
species.

Profile 4 : On loessial loam.

Typical leached brown earth with Querceto-Carpinetum
stachyetosum numerous in species.

**Profile 5 : Dissolution clay on limestone and dolo-
mites.**

Degraded rendzine.

Querceto-carpinetum stachyetosum numerous in species.

Profile 6 : Dolomitic sand.

Humo-carbonates and superficial rendzine

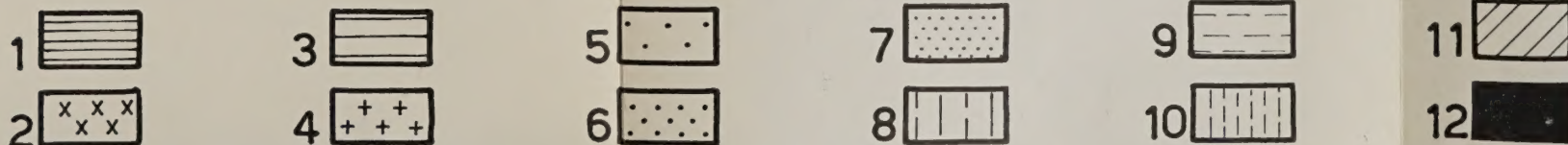
Querceto-carpinetum primulatosum (Mercurialis and
Corydale facies).





Fig. 5

100 0 100 300 500m



DETAILED SOIL MAP OF A PART OF THE LAND OF AALST (Commons of Meldert and Baardegem)

CARTE PEDOLOGIQUE DETAILLEE D'UNE PARTIE DU PAYS D'AALST (Communes de Meldert et de Baardegem)

Survey : R. MARECHAL, Lic. Sc. (C.V.B. — Univ. Gent).
 Levé :

Legend — Légende :

- | | |
|---|--|
| <p>1. Sandy loam, resting on tertiary clay at less than 60 cms.
 Limon sableux, reposant sur argile tertiaire à moins de 60 cm.</p> <p>2. Sandy loam, resting on tertiary sand at less than 60 cms.
 Limon sableux, reposant sur sable tertiaire à moins de 60 cm.</p> <p>3. Sandy loam, resting on tertiary clay between 60 and 125 cms.
 Limon sableux, reposant sur argile tertiaire entre 60 et 125 cm.</p> <p>4. Sandy loam, resting on tertiary sand between 60 and 125 cms.
 Limon sableux, reposant sur sable tertiaire entre 60 et 125 cm.</p> <p>5. Sandy loam, more than 125 cms; rust specks beginning at more than 80 cms.
 Limon sableux, plus de 125 cm; taches de rouille débutant à plus de 80 cm.</p> <p>6. Sandy loam, more than 125 cms; rust specks beginning between 50 and 80 cms.
 Limon sableux, plus de 125 cm; taches de rouille débutant entre 50 et 80 cm.</p> <p>7. Sandy loam, more than 125 cms; rust specks beginning between 20 and 50 cms; situated at a low topographical level.
 Limon sableux, plus de 125 cm; taches de rouille débutant entre 20 et 50 cm; situé à un niveau topographique bas.</p> | <p>8. Sandy loam, more than 125 cms; rust specks beginning between 20 and 50 cms; situated at a high topographical level.
 Limon sableux, plus de 125 cm; taches de rouille débutant entre 20 et 50 cm; situé à un niveau topographique élevé.</p> <p>9. Sandy loam, more than 125 cms; rust specks beginning between 0 and 20 cms; situated at a low topographical level.
 Limon sableux, plus de 125 cm; taches de rouille débutant entre 0 et 20 cm; situé à un niveau topographique bas.</p> <p>10. Sandy loam, more than 125 cms; rust specks between 0 and 20 cms; situated at a high topographical level.
 Limon sableux, plus de 125 cm; taches de rouille débutant entre 0 et 20 cm; situé à un niveau topographique élevé.</p> <p>11. Artificial soils.
 Sols artificiels.</p> <p>12. Buildings.
 Constructions.</p> |
|---|--|

Querceto-carpinetum stachyetosum few in species,
locally altered into Quercion (Q-B).

Profile 3 : On On_x with white pebbles.

Leached brown earth with superficial degradation
under beech.

Querceto-carpinetum stachyetosum more numerous in
species.

Profile 4 : On loessial loam.

Typical leached brown earth with Querceto-Carpinetum
stachyetosum numerous in species.

**Profile 5 : Dissolution clay on limestone and dolo-
mites.**

Degraded rendzine.

Querceto-carpinetum stachyetosum numerous in species.

Profile 6 : Dolomitic sand.

Humo-carbonates and superficial rendzine

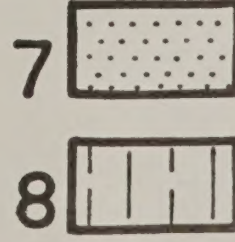
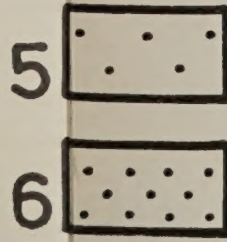
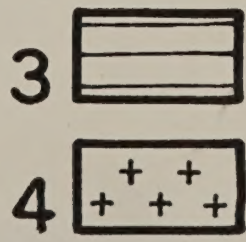
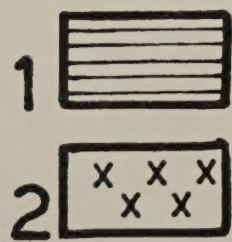
Querceto-carpinetum primulatosum (Mercurialis and
Corydale facies).





Fig. 5

100 0 100 300 500m



DETAILED SOIL MAP OF A PART OF THE LAND OF AALST (Commons)

CARTE PEDOLOGIQUE DETAILLEE D'UNE PARTIE DU PAYS D'AALST (Co)

Survey : R. MARECHAL, Lic. Sc. (C.V.B. — Univ. Gen
Levé :

Legend — Légende :

1. Sandy loam, resting on tertiary clay at less than 60 cms.
Limon sableux, reposant sur argile tertiaire à moins de 60 cm.

8. Sandy loam, more than
situated at a high top
Limon sableux, plus d'

GROUPE QUATÉNAIRE

QUATÉNAIRE : Dépôts de la plaine maritime **alp**

GROUPE TERTIAIRE

PLIOCÈNE **P**

MIOCÈNE **M**

OLIGOCÈNE **O**

EOCÈNE **E**

GROUPE SECONDAIRE

PALEOCÈNE **P**

CRETACE **C**

JURASSIQUE **J**

TRIASSIQUE **T**

GROUPE PRIMAIRE

CARBONIFÉRIEN { houiller **h**
calcaire **c**

DEVONIEN **D**

SILURIEN **S**

CAMBRIEN **C**

ROCHES ÉRUPTIVES **R**

Délimitation hypothétique du terrain houiller

Fig. 1

GENT
GAND
GHEENT

Overzichts bodemkaart 55E - 56W
CARTE GENERALE DES SOLS - GENERAL SOIL MAP

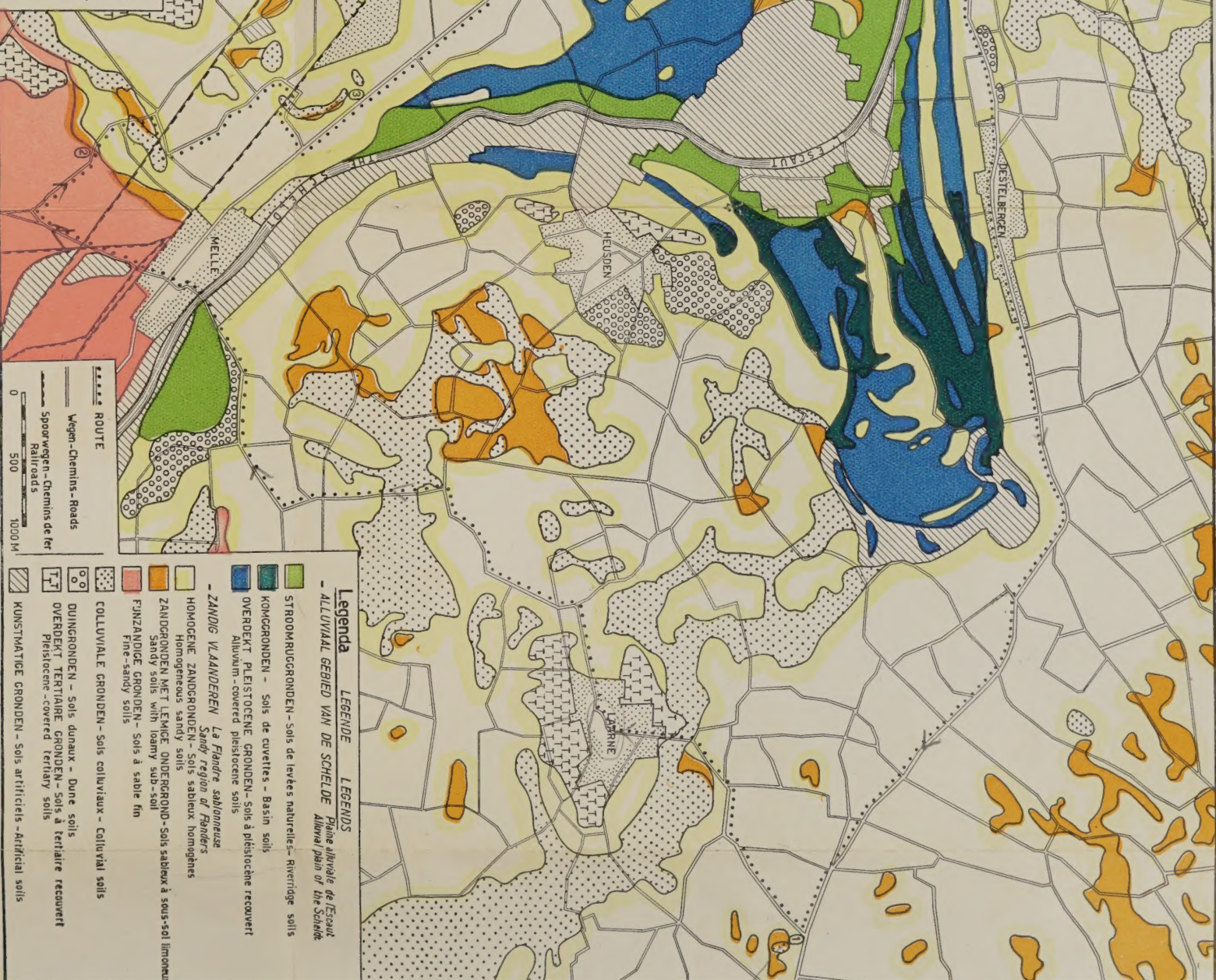
opname -

levée par -

drawn by -

F. R. MOORMANN

I.W.O.M.L. C.V.B. Univ. GENT



ROUTE

Wegen - Chemins - Roads

Spoorwegen - Chemins de fer
Railroads

0 500 1000 M

Legenda

LEGENDE

LEGENDS

- ALLUVIAAL GEBIED VAN DE SCHELDE
Plaine alluviale de l'Escaut
Alluvial plain of the Scheldt

STROOMRUICGRONDEN - sols de levées naturelles - riverbed soils

KOMGRONDEN - sols de cuvettes - Basin soils

OVERDEKT PLEISTOCENE GRONDEN - sols à pléistocène recouvert
Alluvium-covered pleistocene soils

ZANDIG VLAANDEREN - La Flandre sablonneuse

HOMOGENE ZANDGRONDEN - sols sableux homogènes
Homogeneous sandy soils

ZANDGRONDEN MET LEVIGE ONDERGROND - sols sableux à sous-sol limoneux
Sandy soils with loamy sub-soil

FIJNZANDIGE GRONDEN - sols à sable fin
Fine-sandy soils

COLLUVIALE GRONDEN - sols colluviaux - Colluvial soils

DUNGRONDEN - sols dunaux - Dune soils

OVERDEKT TERTIAIRE GRONDEN - sols à tertiaire recouvert
Pleistocene-covered tertiary soils

KUNSTMATIGE GRONDEN - sols artificiels - Artificial soils

Fig. 2



OVERZICHTSBODEMKAART VAN HET LAND VAN WAAS. RECONNAISSANCE SOIL-MAP OF THE LAND OF WAAS.

Opgenomen door :

levée par :
F. SNACKEN

survey :

I.W.O.N.L. — C.V.B. Univ. Gent.

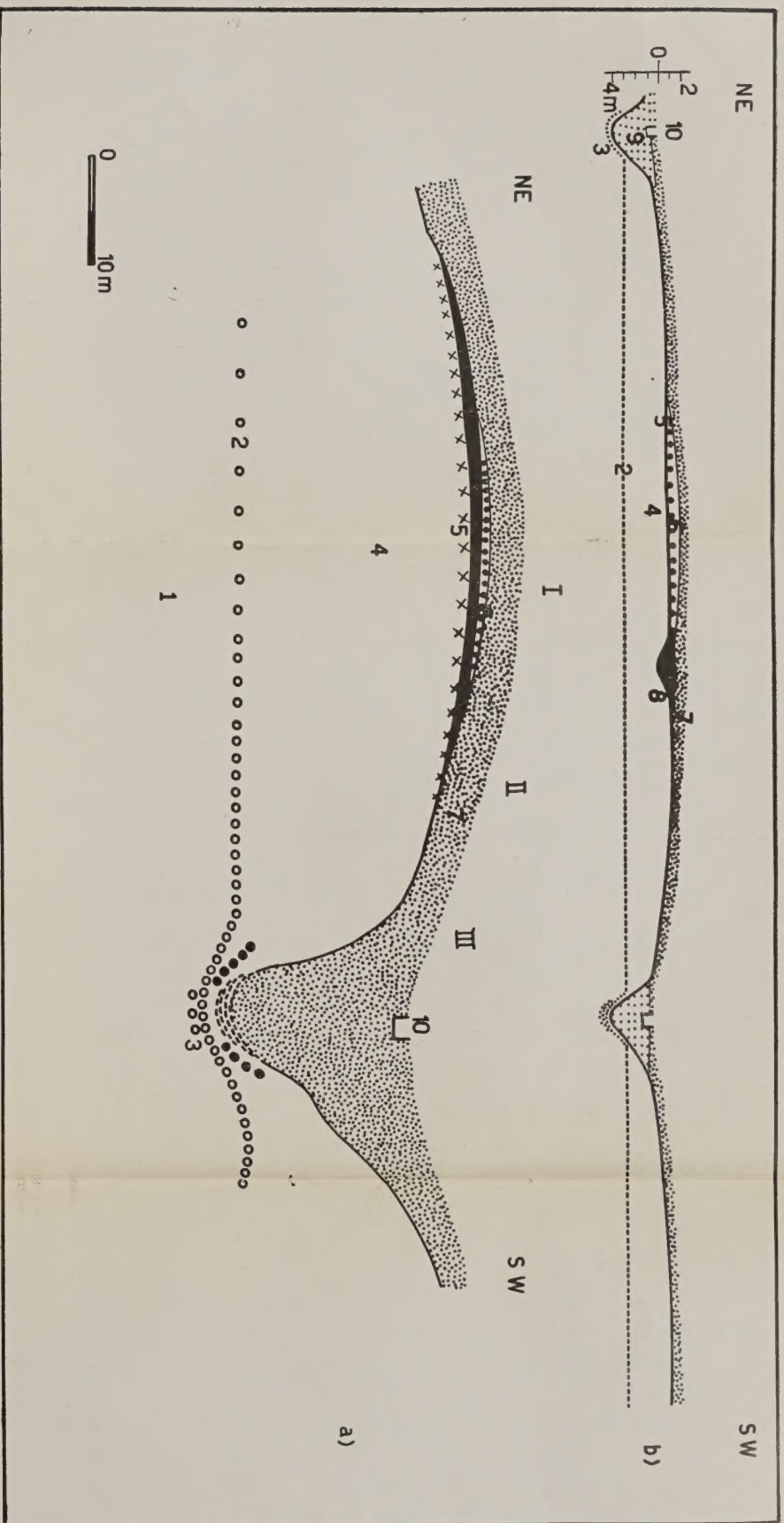


Fig. 4: COUPES SCHEMATIQUES DE CHAMPS BOMBES
SCHEMATIC CROSS-SECTIONS OF « ROUNDED FIELDS »

dessin de : F. SNACKEN
drawn by :

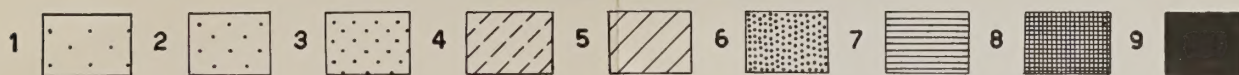
- a. St. Pauwels.
- b. Argilière S.V.K. St. Nicolas.
Clay-pit S.V.K., St. Nikolaas.
11. Centre de la parcelle, généralement situé à $\pm 1 \frac{1}{2}$ m au dessus du niveau des limites parcelaires.
- Centre of the parcels, generally situated about 1 1/2 m above the level of the parcel-limits.
10. Fossé de drainage actuel.
- Actual drainage ditch.
9. Dépôt de colmatage (sableux, gris noirâtre) d'anciennes dépressions; à la base on trouve des débris de plantes (e.a. Salix).
- Depositions filled up with black-greyish sandy material; remnants of plants occur at the bottom (Salix).
8. Cuvette colmatée par du sable noirâtre et gris blanchâtre. On y trouve des tessons préhistoriques et des Silex taillés.
- Small depression filled up with black and greyish-white sand. Potsherds and artefacts occur.
7. Terre arable — constituée de sable gris brunâtre. Sur toute l'épaisseur de cette couche on retrouve quelques cailloux épars et dents de squales, provenant vraisemblablement du niveau n° 2.
- Top-soil, formed of grey-brown sand. Small pebbles and a few teeth of squales occur through the whole layer; these teeth originate probably from layer n° 2.

- 3+2. Mince couche de 10-20 cm de galets de quartz et de silex, parfois mélangée de sable verdâtre (Anversien), dents de squales et fragments de coquilles. Localement (3) cette couche est cryoturpée.
- Thin layer of quartz and flint pebbles, sometimes mixed with greenish sand (Anversien), teeth of squales and fragments of shells. Locally this layer is cryoturpated (3).
1. Argile tertiaire (argille Rupélienne).
- Tertiary clay (Rupelian clay, Middle-Oligocene).
6. Sable noirâtre (horizon B1 d'un podsol de bruyère). Parfois on trouve des traces de l'horizon A2.
- Blackish sand (B1 horizon of a heather podsol-profile). Occasionally, leached layers (A2) are also present.
5. Couche d'illios (horizon B2 d'un podsol de bruyère).
- Brown iron-pan, often firm (B2 horizon of a heather-podsol profile).
4. Sable de couverture, localement cryoturpé, contenant des linéoles limonneuses (horizon C).
- Cover-sand, locally cryoturpated; with thin loamy layers (C-horizon).



Fig. 3

0 500m.



CARTE DETAILLEE D'UNE PARTIE DU PAYS DE WAAS (St. Pauwels)

DETAILED SOIL-MAP OF A PART OF THE LAND OF WAAS (St. Pauwels)

Levé : F. SNACKEN (I.W.O.N.L. — C.V.B., Univ. Gent)
Survey:

Légende — Legend:

Sols sableux — Sandy soils.

1. Sol sableux élevé, pauvre en humus.
High sandy soil, with low humus content.
2. Sol sableux élevé, de couleur grisâtre.
High grey sandy soil.
3. Sol sableux élevé de couleur brunâtre.
High brown sandy soil.
4. Sol sableux, moyennement élevé, de couleur grisâtre.
Medium high grey sandy soil.
5. Sol sableux, moyennement élevé, de couleur brunâtre.
Medium high brown sandy soil.

6. Sol sableux bas, de couleur brunâtre.
Low brown sandy soil.

Sols colluviaux — Colluvial soils.

7. Sols limono-sableux.
Loamy-sand soil.
8. Sol sablo-limoneux.
Sandy-loam soil.
9. Sols artificiels.
Artificial soils.



Fig. 3

0 500m.



CARTE DETAILLEE D'UNE PARTIE DU PAYS DE WAAS (St. Pauwels)

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High brown sandy soil.
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Medium high grey sandy soil.
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Medium high brown sandy soil.

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Low brown sandy soil.

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